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Scientific and Technical Information Program Office

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NASA STI Program ... in Profile

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NASA Center for AeroSpace Information (CASI)

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The U.S. Patent and Trademark Office provides online access to full text patents and patent applications. The database includes patents back to 1976 plus some pre-1975 patents. Visit the USPTO at http://www.uspto.gov/patft/.

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Subject Divisions/Categories

Document citations are grouped by division and then by category, according to the *NASA Scope and Coverage Category Guide.*

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Engineering

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Life Sciences

Mathematical and Computer Sciences

Physics

Social and Information Sciences

Space Sciences

General

Indexes

Two indexes are available. You may use the find command under the tools menu while viewing the PDF file for direct match searching on any text string. You may also select either of the two indexes provided for linking to the corresponding document citation from *NASA Thesaurus* terms and personal author names.

SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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VOLUME 42, SEPTEMBER 10, 2004

20040086230 Naval Academy, Annapolis, MD

Synthesis of a Controller for Swarming Robots Performing Underwater Mine Countermeasures

Tan, Yong C.; May 6, 2004; 111 pp.; In English; Original contains color illustrations

Report No.(s): AD-A424661; USNA-TSPR-328; No Copyright; Avail: CASI; A06, Hardcopy

This Trident Scholar project involved the synthesis of a swarm controller that is suitable for controlling movements of a group of autonomous robots performing underwater mine countermeasures (UMCM). The main objective of this research project was to combine behavior- based robot control methods with systems-theoretic swarm control techniques to achieve a hybrid that has the best characteristics of both. The sub-goals were: a) To simulate and study a simplified version of the UMCM problem, in 2D with basic robot dynamics and behaviors. b) To investigate the performance of both behavior-based and systems-theoretic controllers for UMCM, and to determine their advantages and disadvantages. Careful development of behavior-based methods using a non-traditional differential equations approach facilitated the hybridization of the two controllers under study, giving rise to a more functional controller capable of controlling swarm level functions while executing the appropriate behaviors at the same time.

DTIC

Autonomous Navigation; Controllers; Countermeasures; Robots; Swarming

01
AERONAUTICS (GENERAL)

Includes general research topics related to manned and unmanned aircraft and the problems of flight within the Earth's atmosphere. Also includes manufacturing, maintenance, and repair of aircraft. For specific topics in aeronautics, see *categories 02 through 09*. For information related to space vehicles *see 12 Astronautics*.

20040086704 NASA Glenn Research Center, Cleveland, OH, USA

Turbomachine Sealing and Secondary Flows, Part 1, Review of Sealing Performance, Customer, Engine Designer, and Research Issues

Hendricks, R. C.; Steinetz, B. M.; Braun, M. J.; July 2004; 53 pp.; In English; Second International Symposium on Stability Control of Rotating Machinery, 4-8 Aug. 2003, Gdansk, Poland

Report No.(s): NASA/TM-2004-211991/PT1; E-13662-1/PT1; No Copyright; Avail: CASI; A04, Hardcopy

Although forces outside our control shape our industry, turbomachine sealing research, design, and customer agendas established in 1978 by Ludwig, Campbell, and Smith in terms of specific fuel consumption and performance remain as objectives today. Advances have been made because failures of the space shuttle main engine turbomachinery ushered in a new understanding of sealing in high-power-density systems. Further, it has been shown that changes in sealing, especially for high-pressure rotors, dramatically change the performance of the entire engine or turbomachine. Maintaining seal leakages and secondary flows within engine design specifications remains the most efficient and cost effective way to enhance performance and minimize maintenance costs. This three-part review summarizes experiences, ideas, successes, and failures by NASA and the U.S. aerospace industry in secondary flow management in advanced turbomachinery. Part 1 presents system sealing, part 2 system rotordynamics, and part 3 modeling, with some overlap of each part.

Derived from text

Turbomachinery; Sealing; Engine Design; Maintenance; Secondary Flow; Design Analysis

20040086720 NASA Langley Research Center, Hampton, VA, USA

Synthesis of Optimal Constant-Gain Positive-Real Controllers for Passive Systems

Mao, Y.; Kelkar, A. G.; Joshi, S. M.; [1999]; 5 pp.; In English; Copyright; Avail: CASI; A01, Hardcopy

This paper presents synthesis methods for the design of constant-gain positive real controllers for passive systems. The results presented in this paper, in conjunction with the previous work by the authors on passification of non-passive systems, offer a useful synthesis tool for the design of passivity-based robust controllers for non-passive systems as well. Two synthesis approaches are given for minimizing an LQ-type performance index, resulting in optimal controller gains. Two separate algorithms, one for each of these approaches, are given. The synthesis techniques are demonstrated using two numerical examples: control of a flexible structure and longitudinal control of a fighter aircraft.
Author
Aircraft Control; Algorithms; Control Systems Design

20040086722 NASA Glenn Research Center, Cleveland, OH, USA
Turbomachine Sealing and Secondary Flows, Part 2, Review of Rotordynamics Issues in Inherently Unsteady Flow Systems With Small Clearances
Hendricks, R. C.; Tam, L. T.; Muszynska, A.; July 2004; 80 pp.; In English; Second International Symposium on Stability Control of Rotating Machinery, 4-8 Aug. 2003, Gdansk, Poland
Report No.(s): NASA/TM-2004-211991/PT2; E-13662-2/PT2; No Copyright; Avail: CASI; A05, Hardcopy

Today's computational methods enable the determination of forces in complex systems, but without field validation data, or feedback, there is a high risk of failure when the design envelope is challenged. The data of Childs and Bently and field data reported in NASA Conference Proceedings serve as sources of design information for the development of these computational codes. Over time all turbomachines degrade and instabilities often develop, requiring responsible, accurate, turbomachine diagnostics with proper decisions to prevent failures. Tam et al. (numerical) and Bently and Muszynska (analytical) models corroborate and implicate that destabilizing factors are related through increases in the fluid-force average circumferential velocity. The stability threshold can be controlled by external swirl and swirl brakes and increases in radial fluid film stiffness (e.g., hydrostatic and ambient pressures) to enhance rotor stability. Also cited are drum rotor self-excited oscillations, where the classic fix is to add a split or severed damper ring or cylindrical damper drum, and the Benkert-Wachter work that engendered swirl brake concepts. For a smooth-operating, reliable, long-lived machine, designers must pay very close attention to sealing dynamics and diagnostic methods. Correcting the seals enabled the space shuttle main engine high-pressure fuel turbopump (SSME HPFTP) to operate successfully.
Author
Turbomachinery; Sealing; Secondary Flow; Rotor Dynamics; Complex Systems; Hydrostatics

20040086723 NASA Glenn Research Center, Cleveland, OH, USA
Turbomachine Sealing and Secondary Flows, Part 3, Review of Power-Stream Support, Unsteady Flow Systems, Seal and Disk Cavity Flows, Engine Externals, and Life and Reliability Issues
Hendricks, R. C.; Steinetz, B. M.; Zaretsky, E. V.; Athavale, M. M.; Przekwas, A. J.; July 2004; 54 pp.; In English; Second International Symposium on Stability Control of Rotating Machinery, 4-8 Aug. 2003, Gdansk, Poland
Report No.(s): NASA/TM-2004-211991/PT3; E-13662-3/PT3; No Copyright; Avail: CASI; A04, Hardcopy

The issues and components supporting the engine power stream are reviewed. It is essential that companies pay close attention to engine sealing issues, particularly on the high-pressure spool or high-pressure pumps. Small changes in these systems are reflected throughout the entire engine. Although cavity, platform, and tip sealing are complex and have a significant effect on component and engine performance, computational tools (e.g., NASA-developed INDSEAL, SCISEAL, and ADPAC) are available to help guide the designer and the experimenter. Gas turbine engine and rocket engine externals must all function efficiently with a high degree of reliability in order for the engine to run but often receive little attention until they malfunction. Within the open literature statistically significant data for critical engine components are virtually nonexistent; the classic approach is deterministic. Studies show that variations with loading can have a significant effect on component performance and life. Without validation data they are just studies. These variations and deficits in statistical databases require immediate attention.
Author
Turbomachinery; Sealing; Secondary Flow; Engine Parts; Component Reliability; Steady Flow

20040086848 NASA Langley Research Center, Hampton, VA, USA
Verification and Analysis of Formulation 4 of Langley for the Study of Noise From High Speed Surfaces
Farassat, F.; Farris, Mark; [1999]; 20 pp.; In English; 5th AIAA/CEAS Aeroacoustics Conference, 10-12 May 1999, Bellevue, WA, USA
Report No.(s): AIAA Paper 99-1881; Copyright; Avail: CASI; A03, Hardcopy

There are several approaches to the prediction of the noise from sources on high speed surfaces. Two of these are the Kirchhoff and the Ffowcs williams-Hawkings methods. It can be shown that both of these methods depend on the solution of the wave equation with mathematically similar inhomogeneous source terms. Two subsonic solutions known as Formulation 1 and 1A of Langley are simple and efficient for noise prediction. The supersonic solution known as Formulation 3 is very complicated and difficult to code. Because of the complexity of the result, the computation time is longer than the subsonic formulas. Furthermore, it is difficult to assess the accuracy of noise prediction. We have been searching for a new and simpler supersonic formulation without these shortcomings. In the last AIAA Aeroacoustics Conference in Toulouse, Farassat, Dunn and Brentner presented a paper in which such a result was presented and called Formulation 4 of Langley. In this paper we will present two analytic tests of the validity this Formulation: 1) the noise from dipole distribution on the unit circle whose strength varies radially with the square of the distance from the center and 2) the noise from dipole distribution on the unit sphere whose strength varies with the cosine of the angle from the polar axis. We will discuss the question of singularities of Formulation 4.
Author
Aeroacoustics; Computation; High Speed; Noise Prediction

02
AERODYNAMICS

Includes aerodynamics of flight vehicles, test bodies, airframe components and combinations, wings, and control surfaces. Also includes aerodynamics of rotors, stators, fans, and other elements of turbomachinery. For related information see also *34 Fluid Mechanics and Thermodynamics*.

20040086103 Alabama Univ., Tuscaloosa, AL
Investigation of Combined Low-Angled Jets and Variable Wall Geometry for Hypersonic Aerodynamic Control
Bowersox, Rodney D.; Karr, Charles L.; Sharif, Muhammad; May 5, 2004; 84 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0329
Report No.(s): AD-A424384; UA-AEM-AOPL-2000-001; AFRL-SR-AR-TR-04-0356; No Copyright; Avail: CASI; A05, Hardcopy

The principal objective of the present research proposal was to investigate, experimentally and numerically, the use of jets to actively control the aerodynamic forces for high-speed flight vehicles. As a test bed, single port injection into a Mach 5.0 crossflow through diamond and circular orifices, at various incidence angles and momentum ratios were examined. To meet the objective, a research program was performed to characterize and control the secondary flow structures associated with the jet interaction flows. The research approach was divided into three main thrusts. First, fundamental studies to characterize the mean and turbulent flow structure were performed. This included detailed experiments at Mach 5.0 using advanced optical diagnostics and numerical simulations using two-equation RANS turbulence modeling. The flow field characterization included shock structures, surface pressure, vorticity and turbulence. Second, the numerical simulations were studied to assess vorticity and turbulent transport mechanisms. Lastly, parametric experiments and Reynolds averaged Navier-Stokes simulations were performed to quantify vorticity control. This included manipulating the jet shock structure to modify the vorticity field, adding downstream ramps to utilize the Magnus force, varying the injector geometry, incidence angle and momentum ratio.
DTIC
Aerodynamics; Control Surfaces; Hypersonic Flow; Hypersonics; Jet Flow; Walls

20040086159 NTI, Inc., Dayton, OH
Measurement and Modeling of Human Performance Under Differing G Conditions
O'Donnell, Robert D.; Moise, Samuel L.; Schmidt, Regina; Smith, Richard; Oct. 2003; 163 pp.; In English
Contract(s)/Grant(s): F33615-01-C-6018; Proj-3005
Report No.(s): AD-A424501; AFRL-HE-WP-TR-2004-0034; No Copyright; Avail: CASI; A08, Hardcopy

A synthesis of past literature on cognitive skills identified by pilots as being critical in the acceleration environment was performed. These skills include various kinds of decision making, tracking, spatial orientation, time/ velocity estimation, perceptual speed, visual function, and instrument reading. Since the literature base on these skills is far from complete, a new test battery designed specifically to address these cognitive skills was developed. The 'G- Performance Assessment Simulation System' (G-PASS) consists of twelve cognitive performance tests designed to be used in the centrifuge, and consists of both stand-alone' tests and others that are presented within an aerodynamically accurate simulation of the F-16 aircraft. In addition,

to utilize these data in a user-friendly model, the ‘G-effective’ hemodynamic model developed previously has been adapted to the available performance data. The end product of these efforts is the ‘G- Tool to Optimize Performance’ (0-TOP). This is a model-based graphical presentation of the second-by-second effects of any G profile on nine cognitive functions. The user simply specifies the desired profile and the decrement in each cognitive function is automatically calculated and displayed as an integrated, dynamic picture - a ‘Cognitive Vulnerability Map’ (CVM).
DTIC
Cognition; Decision Making; Human Performance; Performance Prediction

20040086184 Georgia Inst. of Tech., Atlanta, GA
A New Approach to Aeroelastic Response, Stability and Loads of Missiles and Projectiles
Hodges, Dewey H.; Jan. 2004; 43 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-00-1-0408
Report No.(s): AD-A424568; ARO-40448.2-EG; No Copyright; Avail: CASI; A03, Hardcopy

A current trend in the development of missiles is in the direction of more flexibility, higher maneuverability, and higher speeds, all of which require a higher level of fidelity for calculations of stability, loads, control, and guidance. To address these issues, the present interdisciplinary basic research was conducted involving structural analysis, dynamics, dynamic stability, aeroelastic stability, and trajectory analysis of missiles, rockets, and projectiles. A computer code for the dynamic stability, structural dynamics and aeroelastic response of the missile has been written using a geometrically exact, mixed finite element method. The aerodynamic modeling of the loading for the missile body and fins is based on slender body theory and thin-airfoil theory, respectively. Results agree with published results for dynamic stability in addition to limit cycle oscillations for disturbed flight near and above the critical thrust. Parametric studies for specific flexible missile configurations are presented, including effects of flexibility on stability, limit-cycle amplitudes, and missile loads. Although results indicate little potential for affecting aeroelastic stability by use of composite couplings, they do exhibit significant interaction between aeroelastic effects and the thrust, a follower force.
DTIC
Aeroelasticity; Dynamic Response; Loads (Forces); Missiles; Projectiles; Stability

20040086269 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Outside Loop Control in Asymmetrical Trimmed Flight Conditions
Miller, Gary D.; Feb. 2004; 145 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424733; AFIT/GAE/ENY/04-M12; No Copyright; Avail: CASI; A07, Hardcopy

Traditionally flight control systems have used linearized equations of motion solved around a single trim point. This thesis proposes a nested-loop controller directly solved from the equations of motion. The control equations were developed as a solution to asymmetrically trimmed flight conditions. A two-loop design was proposed for the controller. The outer loop modeled the aircraft as a point mass and all forces were balanced to find the aircraft states. The equations input the control variables and output the aircraft states. The inner-loop utilizes the six-degree of freedom model of the aircraft to solve the moment equations. With the input states, the required control surface deflections are calculated. The control equations were investigated for typical flight conditions to find the predicted aircraft control settings. The control equations were implemented using aeromodel data for a Learjet-25. The predictions from the control equations were then compared to flight test results. The model was able to predict the required elevator deflection for simple longitudinal cases in level and climbing flight to within tolerances. The simple lateral-directional cases were not as accurate as the longitudinal investigations. As complex maneuvers were investigated, the model predictions did not match the flight test results.
DTIC
Aerodynamic Balance; Aerodynamic Characteristics; Asymmetry; Equations of Motion; Flight Conditions; Flight Control; Flight Tests

20040086272 Naval Postgraduate School, Monterey, CA
Numerical Prediction of the Impact of Non-Uniform Leading Edge Coatings On the Aerodynamic Performance of Compressor Airfoils
Elmstrom, Michael E.; Jun. 2004; 91 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424742; No Copyright; Avail: CASI; A05, Hardcopy

A computational fluid dynamic (CFD) investigation is presented that provides predictions of the aerodynamic impact of uniform and non-uniform coatings applied to the leading edge of a compressor airfoil in a cascade. Using a NACA 65(12)10

airfoil, coating profiles of varying leading edge non-uniformity were added. This non-uniformity is typical of that expected due to fluid being drawn away from the leading edge during the coating process. The CFD code, RVCQ3D, is a steady, quasi-three-dimensional Reynolds Averaged Navier- Stokes (RANS) solver. A k-omega turbulence model was used for the Reynolds Stress closure. The code predicted that these changes in leading edge shape can lead to alternating pressure gradients in the first few percent of chord that create small separation bubbles and possibly early transition to turbulence. The change in total pressure loss and trailing edge deviation are presented as a function of the coating non-uniformity parameter. Results are presented for six leading edge profiles over a range of incidences and inlet Mach numbers from 0.6 to 0.8. Reynolds number was 600,000 and free-stream turbulence was 6%. A two-dimensional map is provided that shows the allowable degree of coating non-uniformity as a function of incidence and inlet Mach number.
DTIC
Aerodynamic Characteristics; Aerodynamics; Airfoils; Compressor Blades; Compressors; Leading Edges; Mathematical Models; Nonuniformity; Turbocompressors

20040086577 NASA Langley Research Center, Hampton, VA, USA
An Integrated MEMS Sensor Cluster System for Aerospace Applications
Kahng, Seun; Scott, Michael A.; Beeler, George B.; Bartlett, James E.; Collins, Richard S.; [2000]; 7 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

Efforts to reduce viscous drag on airfoils could results in a considerable saving for the operation of flight vehicles including those of space transportation. This reduction of viscous drag effort requires measurement and active control of boundary layer flow property on an airfoil. Measurement of viscous drag of the boundary layer flow over an airfoil with minimal flow disturbance is achievable with newly developed MEMS sensor clusters. These sensor clusters provide information that can be used to actively control actuators to obtain desired flow properties or design a vehicle to satisfy particular boundary layer flow criteria. A series of MEMS sensor clusters has been developed with a data acquisition and control module for local measurements of shear stress, pressure, and temperature on an airfoil. The sensor cluster consists of two shear stress sensors, two pressure sensors, and two temperature sensors on a surface area of 1.24 mm x 1.86 mm. Each sensor is 300 microns square and is placed on a flexible polyimide sheet. The shear stress sensor is a polysilicon hot-film resistor, which is insulated by a vacuum cavity of 200 x 200 x 2 microns. The pressure sensors are silicon piezoresistive type, and the temperature sensors are also hot film polysilicon resistors. The total size of the cluster including sensors and electrical leads is 1 Omm x 1 Omm x 0.1 mm. A typical sensitivity of shear stress sensor is 150 mV/Pascal, the pressure sensors are an absolute type with a measurement range from 9 to 36 psia with 0.8mV/V/psi sensitivity, and the temperature sensors have a measurement resolution of 0.1 degree C. The sensor clusters are interfaced to a data acquisition and control module that consists of two custom ASICs (Application Specific Integrated Circuits) and a micro-controller. The data acquisition and control module transfers data to a host PC that configures and controls a total of three sensor clusters. Functionality of the entire system has been tested in the laboratory, and preliminary test results are presented.
Derived from text
Microelectromechanical Systems; Aerospace Engineering; Application Specific Integrated Circuits; Pressure Sensors; Electric Conductors; Flow Characteristics; Pascal (Programming Language); Polyimides

20040086679 NASA Langley Research Center, Hampton, VA, USA
Development of X-33/X-34 Aerothermodynamic Data Bases: Lessons Learned and Future Enhancements
Miller, C. G.; [1999]; 12 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

A synoptic of programmatic and technical lessons learned in the development of aerothermodynamic data bases for the X-33 and X-34 programs is presented in general terms and from the perspective of the NASA Langley Research Center Aerothermodynamics Branch. The format used is that of the aerothermodynamic chain, the links of which are personnel, facilities, models/test articles, instrumentation, test techniques, and computational fluid dynamics (CFD). Because the aerodynamic data bases upon which the X-33 and X-34 vehicles will fly are almost exclusively from wind tunnel testing, as opposed to CFD, the primary focus of the lessons learned is on ground-based testing.
Author (revised)
X-33 Reusable Launch Vehicle; X-34 Reusable Launch Vehicle; Aerothermodynamics; Data Bases; Wind Tunnel Tests

20040086731 NASA Langley Research Center, Hampton, VA, USA
Transonic Flutter Suppression Control Law Design, Analysis and Wind-Tunnel Results
Mukhopadhyay, Vivek; [1999]; 12 pp.; In English; International Forum on Aeroelasticity and Structural Dynamics 1999, 22-25 Jun. 1999, Williamsburg, VA, USA; No Copyright; Avail: CASI; A03, Hardcopy

The benchmark active controls technology and wind tunnel test program at NASA Langley Research Center was started with the objective to investigate the nonlinear, unsteady aerodynamics and active flutter suppression of wings in transonic flow. The paper will present the flutter suppression control law design process, numerical nonlinear simulation and wind tunnel test results for the NACA 0012 benchmark active control wing model. The flutter suppression control law design processes using classical, and minimax techniques are described. A unified general formulation and solution for the minimax approach, based on the steady state differential game theory is presented. Design considerations for improving the control law robustness and digital implementation are outlined. It was shown that simple control laws when properly designed based on physical principles, can suppress flutter with limited control power even in the presence of transonic shocks and flow separation. In wind tunnel tests in air and heavy gas medium, the closed-loop flutter dynamic pressure was increased to the tunnel upper limit of 200 psf. The control law robustness and performance predictions were verified in highly nonlinear flow conditions, gain and phase perturbations, and spoiler deployment. A non-design plunge instability condition was also successfully suppressed.
Author
Unsteady Aerodynamics; Active Control; Flutter; Wind Tunnel Tests; Transonic Flow; Wings

20040086760 NASA Langley Research Center, Hampton, VA, USA
Nonlinear Bulging Factors for Longitudinal and Circumferential Cracks in Cylindrical Shells Subjected to Combined Loads
Young, Richard D.; Rose, Cheryl A.; Starnes, James H., Jr.; [2000]; 15 pp.; In English
Report No.(s): AIAA Paper 2000-1514; Copyright; Avail: CASI; A03, Hardcopy

Results of a geometrically nonlinear finite element parametric study to determine curvature correction factors or bulging factors that account for increased crack-tip stresses due to curvature for longitudinal and circumferential cracks in unstiffened cylindrical shells subjected to combined loads are presented. Nondimensional parameters varied in the study include the shell curvature parameter, l , which is a function of the shell radius, the shell wall thickness, and the crack length; a pressure loading parameter, h , which is a function of the shell geometry, material properties and the applied internal pressure; and a biaxial loading parameter, c , which is the ratio of the farfield axial stress to the farfield circumferential stress. The major results are presented in the form of contour plots of the bulging factor as a function of these three nondimensional parameters. These plots identify the ranges of the shell curvature and loading parameters for which the effects of geometric nonlinearity are significant, and show the effect of the biaxial loads on the value of the bulging factor. Simple empirical expressions for the bulging factor are then derived from the numerical results and are shown to predict accurately the nonlinear response of shells with longitudinal and circumferential cracks.
Derived from text
Cylindrical Shells; Crack Propagation; Finite Element Method; Bulging; Nonlinearity; Axial Stress

20040086763 NASA Langley Research Center, Hampton, VA, USA
A Parametric Study of the Aerodynamic Characteristics of Nose-Cylinder-Flare Bodies at a Mach Number of 6.0
Ashby, George C., Jr.; Cary, Aubrey M., Jr.; June 1965; 76 pp.; In English
Report No.(s): NASA-TN-D-2854; L-4160; No Copyright; Avail: CASI; A05, Hardcopy

Force tests were conducted at a Mach number of 6.0 on nose-cylinder-flare bodies to determine the effect of nose shape, cylinder length, flare angle, and flare length on the longitudinal aerodynamic characteristics. A particular investigation was conducted to determine the effect of flare angle for constant flare length, surface area, and diameter. Results indicated that at a Reynolds number of approximately 0.92 x l0 (exp 6) (based on body diameter), the boundary-layer separation effects were significant only with respect to the slope of the normal-force and pitching-moment curve at low angles of attack. The variations of the aerodynamic characteristics with the various parameters were, in general, similar to those predicted by Newtonian theory below a flare angle of 30 degrees and a ratio of flare base diameter to cylinder diameter of less than approximately 2.2. The limiting diameter ratio is consistent with the extent of the low-constant dynamic-pressure region near the body caused by the bow-shock influences as predicted by axisymmetric characteristic theory. The effects of the various parameters for the flares that exceeded the limiting diameter ratio follow the trends predicted by the computed flow-field properties. The axial force for these flare configurations at zero angle of attack was, in general, computed within 10 percent by using these properties. For a constant flare length and surface area the flare effectiveness increased with increasing flare angle; however, for constant flare diameter only the axial-force coefficient was affected by flare angle.
Author
Aerodynamic Characteristics; Angle of Attack; Reynolds Number; Shock Waves; Cones; Flared Bodies; Hypersonic Speed; Reentry Vehicles

20040086767 NASA Langley Research Center, Hampton, VA, USA

Numerical Study of Wake Vortex Interaction with the Ground Using the Terminal Area Simulation System

Proctor, Fred H.; Han, Jongil; [1999]; 13 pp.; In English; 37th AIAA Aerospace Sciences Meeting and Exhibit, 11-14 Jan. 1999, Reno, NV, USA

Report No.(s): AIAA Paper 99-0754; Copyright; Avail: CASI; A03, Hardcopy

A sensitivity study for the in-ground effect on aircraft wake vortices has been conducted using a validated large eddy simulation model. The numerical results are compared with observed data and show good agreement for vortex decay and lateral vortex transport. The vortex decay rate is strongly influenced by the ground, but appears somewhat insensitive to ambient turbulence. In addition, the results show that the ground can affect the trajectory and descent-rate of a wake vortex pair at elevations up to about 3 b(sub o) (where b(sub o) is the initial vortex separation). However, the ground does not influence the average circulation of the vortices until the cores descend to within about 0.6 b(sub o), after which time the ground greatly enhances their rate of demise. Vortex rebound occurs in the simulations, but is more subtle than shown in previous numerical studies.

Author

Aircraft Wakes; Ground Effect (Aerodynamics); Vortices; Numerical Analysis; Systems Simulation; Terminals

20040086777 NASA Langley Research Center, Hampton, VA, USA

Numerical Study of Wake Vortex Behavior in Turbulent Domains with Ambient Stratification

Switzer, George F.; Proctor, Fred H.; [2000]; 15 pp.; In English; 38th Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2000, Reno, NV, USA

Contract(s)/Grant(s): NAS1-99074

Report No.(s): AIAA Paper 2000-0755; Copyright; Avail: CASI; A03, Hardcopy

A three-dimensional large eddy simulation model is used to investigate the sensitivity of ambient stratification with turbulence on the behavior of aircraft wake vortices. Modeled ambient turbulence levels range from very weak to moderate, and stratification levels range from strongly stable to unstable. The results of profound significance from this study are: 1) very little sensitivity between vortex linking time and the level of stratification, 2) the mean vortex separation remained nearly constant regardless of stratification and turbulence (at least prior to linking), 3) the wake vortices did not rise regardless of the level of stratification, and 4) for very strong stratification, the vortex stopped descending and quickly dissipated even before vortex linking could occur. These results are supported by experimental data and are contrary to conclusions from other numerical studies that assume laminar flow and/or relatively-low Reynolds numbers.

Author

Aircraft Wakes; Large Eddy Simulation; Three Dimensional Models; Turbulence; Vortices

20040086791 NASA Langley Research Center, Hampton, VA, USA

Large Eddy Simulation of Aircraft Wake Vortices in a Homogeneous Atmospheric Turbulence: Vortex Decay and Descent

Han, Jongil; Lin, Yuh-Lang; Arya, S. Pal; Proctor, Fred H.; [1999]; 22 pp.; In English; 37th AIAA Aerospace Sciences Meeting and Exhibit, 11-14 Jan. 1999, Reno, NV, USA

Contract(s)/Grant(s): NAS1-18925; NCC1-188

Report No.(s): AIAA Paper 99-0756; Copyright; Avail: CASI; A03, Hardcopy

The effects of ambient turbulence on decay and descent of aircraft wake vortices are studied using a validated, three-dimensional: large-eddy simulation model. Numerical simulations are performed in order to isolate the effect of ambient turbulence on the wake vortex decay rate within a neutrally-stratified atmosphere. Simulations are conducted for a range of turbulence intensities, by injecting wake vortex pairs into an approximately homogeneous and isotropic turbulence field. The decay rate of the vortex circulation increases clearly with increasing ambient turbulence level, which is consistent with field observations. Based on the results from the numerical simulations, simple decay models are proposed as functions of dimensionless ambient turbulence intensity (eta) and dimensionless time (T) for the circulation averaged over a range of radial distances. With good agreement with the numerical results, a Gaussian type of vortex decay model is proposed for weak turbulence: while an exponential type of Tortex decay model can be applied for strong turbulence. A relationship for the vortex descent based on above vortex decay model is also proposed. Although the proposed models are based on simulations assuming neutral stratification, the model predictions are compared to Lidar vortex measurements observed during stable, neutral, and unstable atmospheric conditions. In the neutral and unstable atmosphere, the model predictions appear to be in reasonable agreement with the observational data, while in the stably-stratified atmosphere, they largely underestimate the observed circulation decay with consistent overestimation of the observed vortex descent. The underestimation of vortex decay

during stably-stratified conditions suggests that stratification has an important influence on vortex decay when ambient levels of turbulence are weak.
Author
Aircraft Wakes; Large Eddy Simulation; Vortices; Atmospheric Turbulence; Homogeneous Turbulence; Mathematical Models; Descent

20040086816 NASA Langley Research Center, Hampton, VA, USA
Advances in Projection Moire Interferometry Development for Large Wind Tunnel Applications
Fleming, Gary A.; Soto, Hector L.; South, Bruce W.; Bartram, Scott M.; [1999]; 13 pp.; In English
Report No.(s): Rept-1999-01-5598; No Copyright; Avail: CASI; A03, Hardcopy

An instrument development program aimed at using Projection Moire Interferometry (PMI) for acquiring model deformation measurements in large wind tunnels was begun at NASA Langley Research Center in 1996. Various improvements to the initial prototype PMI systems have been made throughout this development effort. This paper documents several of the most significant improvements to the optical hardware and image processing software, and addresses system implementation issues for large wind tunnel applications. The improvements have increased both measurement accuracy and instrument efficiency, promoting the routine use of PMI for model deformation measurements in production wind tunnel tests.
Author
Wind Tunnel Tests; Moire Interferometry; Image Processing; Wind Tunnel Models; Computer Programs

20040086849 NASA Langley Research Center, Hampton, VA, USA
Determination of Anelastic-Induced Error in Wind Tunnel Test Force and Moment Measurements
Steinle, Frank W., Jr.; Booth, Dennis; Rhew, Ray D.; [1999]; 13 pp.; In English; 37th AIAA Aerospace Sciences Meeting and Exhibit, 11-14 Jan. 1999, Reno, NV, USA
Report No.(s): AIAA Paper 99-0682; Copyright; Avail: CASI; A03, Hardcopy

MicroCraft Inc. performed a specialized calibration of the NASA Langley 104B balance (fabricated from CVM 200 alloy) in their Automatic Balance Calibration System (ABCS) machine to identify and determine the magnitude of anelastic effects in the calibration results. The results analyzed thus far are for the axial-force gage. These results show that anelastic effects for the balance in question are substantial enough to consider revising calibration methodology for situations where highest accuracy is needed. Worst case effects found thus far are of the order of 0.1 percent balance gage capacity. Modeling of the anelastic relaxation process with time constants that are linear with stress level was successful in reducing the uncertainty by at least 50-percent.
Author
Anelasticity; Errors; Wind Tunnel Tests; Fabrication; Pitching Moments; Mathematical Models; Loads (Forces)

20040086854 NASA Langley Research Center, Hampton, VA, USA
Periodic Excitation for Jet Vectoring and Enhanced Spreading
Pack, LaTunia G.; Seifert, Avi; [1999]; 19 pp.; In English; 37th AIAA Aerospace Sciences Meeting and Exhibit, 11-14 Jan. 1999, Reno, NV, USA
Report No.(s): AIAA Paper 99-0672; Copyright; Avail: CASI; A03, Hardcopy

The effects of periodic excitation on the evolution of a turbulent jet were studied experimentally. A short, wide-angle diffuser was attached to the jet exit and excitation was introduced at the junction between the jet exit and the diffuser inlet. The introduction of high amplitude periodic excitation at the jet exit enhances the mixing and promotes attachment of the jet shear-layer to the diffuser wall. Vectoring is achieved by applying the excitation over a fraction of the circumference of the circular jet, enhancing its spreading rate on the excited side and its tendency to reattach to that side. Static deflection studies demonstrate that the presence of the wide-angle diffuser increases the effectiveness of the added periodic momentum due to a favorable interaction between the excitation, the jet shear-layer and the diffuser wall. This point was further demonstrated by the evolution of a wave packet that was excited in the jet shear-layer. Strong amplification of the wave packet was measured with a diffuser attached to the jet exit. The turbulent jet responds quickly (10-20 msec) to step changes in the level of the excitation input. The response scales with the jet exit velocity and is independent of the Reynolds number. Jet deflection angles were found to be highly sensitive to the relative direction between the excitation and the jet flow and less sensitive to the excitation frequency. The higher jet deflection angles were obtained for a diffuser length of about two diameters and for diffusers with half-angles greater than 15 degrees.
Author
Jet Flow; Turbulent Jets; Excitation; Directional Control

20040086883 NASA Langley Research Center, Hampton, VA, USA
An Efficient Inverse Aerodynamic Design Method For Subsonic Flows
Milholen, William E., II; [2000]; 11 pp.; In English; 38th Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2000, Reno, NV, USA
Report No.(s): AIAA Paper 2000-0780; Copyright; Avail: CASI; A03, Hardcopy

Computational Fluid Dynamics based design methods are maturing to the point that they are beginning to be used in the aircraft design process. Many design methods however have demonstrated deficiencies in the leading edge region of airfoil sections. The objective of the present research is to develop an efficient inverse design method which is valid in the leading edge region. The new design method is a streamline curvature method, and a new technique is presented for modeling the variation of the streamline curvature normal to the surface. The new design method allows the surface coordinates to move normal to the surface, and has been incorporated into the Constrained Direct Iterative Surface Curvature (CDISC) design method. The accuracy and efficiency of the design method is demonstrated using both two-dimensional and three-dimensional design cases.
Author
Aircraft Design; Computational Fluid Dynamics; Leading Edges; Supersonic Flow; Airfoil Profiles; Aerodynamic Configurations

20040086885 NASA Ames Research Center, Moffett Field, CA, USA
Application of a Momentum Source Model to the RAH-66 Comanche FANTAIL
Nygaard, Tor A.; Dimanlig, Arsenio C.; Meadowcroft, Edward T.; [2004]; 15 pp.; In English; American Helicopter Society 4th Decennial Specialist Conference on Aeromechanics, 21-23 Jan. 2004, San Francisco, CA, USA
Contract(s)/Grant(s): NAS2-00062; No Copyright; Avail: CASI; A03, Hardcopy

A Momentum Source Model has been revised and implemented in the flow solver OVERFLOW-D. In this approach, the fan forces are evaluated from two-dimensional airfoil tables as a function of local Mach number and angle-of-attack and applied as source terms in the discretized Navier-Stokes equations. The model revisions include a new model for forces in the tip region and axial distribution of the source terms. The model revisions improve the results significantly. The Momentum Source Model agrees well with a discrete blade model for all computed collective pitch angles. The two models agree well with experimental data for thrust vs. torque. The Momentum Source Model is a good complement to Discrete Blade Models for ducted fan computations. The lower computational and labor costs make parametric studies, optimization studies and interactional aerodynamics studies feasible for cases beyond what is practical with a Discrete Blade Model today.
Author
Airfoils; Mach Number; Angle of Attack; Ducted Fans; Mathematical Models; Navier-Stokes Equation; Interactional Aerodynamics; Rotary Wings

20040087099 NASA Langley Research Center, Hampton, VA, USA
Aerodynamic and Aeroelastic Insights using Eigenanalysis
Heeg, Jennifer; Dowell, Earl H.; [2004]; 12 pp.; In English; 40th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference and Exhibit, 12-15 Apr. 1999, Saint Louis, MO, USA
Report No.(s): AIAA Paper 99-1473; Copyright; Avail: CASI; A03, Hardcopy

This paper presents novel analytical results for eigenvalues and eigenvectors produced using discrete time aerodynamic and aeroelastic models. An unsteady, incompressible vortex lattice aerodynamic model is formulated in discrete time; the importance of several modeling parameters is examined. A detailed study is made of the behavior of the aerodynamic eigenvalues both in discrete and continuous time. The aerodynamic model is then incorporated into aeroelastic equations of motion. Eigenanalyses of the coupled equations produce stability results and modal characteristics which are valid for critical and non-critical velocities. Insight into the modeling and physics associated with aeroelastic system behavior is gained by examining both the eigenvalues and the eigenvectors. Potential pitfalls in discrete time model construction and analysis are examined.
Author
Unsteady Aerodynamics; Aeroelasticity; Eigenvalues; Eigenvectors

20040087200 NASA Langley Research Center, Hampton, VA, USA
Aerothermal Heating Predictions for Mars Microprobe
Mitcheltree, R. A.; DiFulvio, M.; Horvath, T. J.; Braun, R. D.; [1998]; 10 pp.; In English; 36th Aerospace Sciences Meeting, 12-15 Jan, 1998, Reno, NV, USA
Report No.(s): AIAA Paper 98-0170; Copyright; Avail: CASI; A02, Hardcopy

A combination of computational predictions and experimental measurements of the aerothermal heating expected on the two Mars Microprobes during their entry to Mars are presented. The maximum, non-ablating, heating rate at the vehicle's stagnation point (at alpha = 0 degrees) is predicted for an undershoot trajectory to be 194 Watts per square centimeters with associated stagnation point pressure of 0.064 atm. Maximum stagnation point pressure occurs later during the undershoot trajectory and is 0.094 atm. From computations at seven overshoot-trajectory points, the maximum heat load expected at the stagnation point is near 8800 Joules per square centimeter. Heat rates and heat loads on the vehicle's afterbody are much lower than the forebody. At zero degree angle-of-attack, heating over much of the hemi-spherical afterbody is predicted to be less than 2 percent of the stagnation point value. Good qualitative agreement is demonstrated for forebody and afterbody heating between CFD calculations at Mars entry conditions and experimental thermographic phosphor measurements from the Langley 20-Inch Mach 6 Air Tunnel. A novel approach which incorporates six degree-of-freedom trajectory simulations to perform a statistical estimate of the effect of angle-of-attack, and other off-nominal conditions, on heating is included.
Author
Aerothermodynamics; Computational Fluid Dynamics; Algorithms; Mars Probes; Wind Tunnel Tests

20040087203 NASA Langley Research Center, Hampton, VA, USA
The NASA-Langley Wake Vortex Modelling Effort in Support of an Operational Aircraft Spacing System
Proctor, Fred H.; [1998]; 20 pp.; In English; 36th Aerospace Sciences Meeting and Exhibit, 12-15 Jan. 1998, Reno, NV, USA
Report No.(s): AIAA Paper 98-0589; Copyright; Avail: CASI; A03, Hardcopy

Two numerical modelling efforts, one using a large eddy simulation model and the other a numerical weather prediction model, are underway in support of NASA's Terminal Area Productivity program. The large-eddy simulation model (LES) has a meteorological framework and permits the interaction of wake vortices with environments characterized by crosswind shear, stratification, humidity, and atmospheric turbulence. Results from the numerical simulations are being used to assist in the development of algorithms for an operational wake-vortex aircraft spacing system. A mesoscale weather forecast model is being adapted for providing operational forecast of winds, temperature, and turbulence parameters to be used in the terminal area. This paper describes the goals and modelling approach, as well as achievements obtained to date. Simulation results will be presented from the LES model for both two and three dimensions. The 2-D model is found to be generally valid for studying wake vortex transport, while the 3-D approach is necessary for realistic treatment of decay via interaction of wake vortices and atmospheric boundary layer turbulence. Meteorology is shown to have an important affect on vortex transport and decay. Presented are results showing that wake vortex transport is unaffected by uniform fog or rain, but wake vortex transport can be strongly affected by nonlinear vertical change in the ambient crosswind. Both simulation and observations show that atmospheric vortices decay from the outside with minimal expansion of the core. Vortex decay and the onset three-dimensional instabilities are found to be enhanced by the presence of ambient turbulence.
Author
Mathematical Models; Vortices; Aircraft Wakes; Aircraft Approach Spacing; Mesometeorology

20040090449 NASA Langley Research Center, Hampton, VA, USA
An Overview of Recent Developments in Computational Aeroelasticity
Bennett, Robert M.; Edwards, John W.; [2004]; 15 pp.; In English; 29th AIAA Fluid Dynamics Conference, 15-18 Jun. 1998, Albuquerque, NM, USA
Report No.(s): AIAA Paper 98-2421; Copyright; Avail: CASI; A03, Hardcopy

The motivation for Computational Aeroelasticity (CA) and the elements of one type of the analysis or simulation process are briefly reviewed. The need for streamlining and improving the overall process to reduce elapsed time and improve overall accuracy is discussed. Further effort is needed to establish the credibility of the methodology, obtain experience, and to incorporate the experience base to simplify the method for future use. Experience with the application of a variety of Computational Aeroelasticity programs is summarized for the transonic flutter of two wings, the AGARD 445.6 wing and a typical business jet wing. There is a compelling need for a broad range of additional flutter test cases for further comparisons. Some existing data sets that may offer CA challenges are presented.
Author
Aeroelasticity; Transonic Flutter; Wings; Computational Fluid Dynamics; Wind Tunnel Tests

20040090466 NASA Langley Research Center, Hampton, VA, USA
Multi-Component Diffusion with Application To Computational Aerothermodynamics
Sutton, Kenneth; Gnoffo, Peter A.; [1998]; 15 pp.; In English; 7th AIAA/ASME Joint Thermophysics and Heat Transfer Conference, 15-18 Jun. 1998, Albuquerque, NM, USA
Report No.(s): AIAA Paper 98-2575; Copyright; Avail: CASI; A03, Hardcopy

The accuracy and complexity of solving multicomponent gaseous diffusion using the detailed multicomponent equations, the Stefan-Maxwell equations, and two commonly used approximate equations have been examined in a two part study. Part I examined the equations in a basic study with specified inputs in which the results are applicable for many applications. Part II addressed the application of the equations in the Langley Aerothermodynamic Upwind Relaxation Algorithm (LAURA) computational code for high-speed entries in Earth's atmosphere. The results showed that the presented iterative scheme for solving the Stefan-Maxwell equations is an accurate and effective method as compared with solutions of the detailed equations. In general, good accuracy with the approximate equations cannot be guaranteed for a species or all species in a multi-component mixture. 'Corrected' forms of the approximate equations that ensured the diffusion mass fluxes sum to zero, as required, were more accurate than the uncorrected forms. Good accuracy, as compared with the Stefan- Maxwell results, were obtained with the 'corrected' approximate equations in defining the heating rates for the three Earth entries considered in Part II.
Author
Aerothermodynamics; Computer Programs; Atmospheric Entry; Gaseous Diffusion

20040090473 Eloret Corp., Moffett Field, CA, USA
A Reduced-Frequency Approach for Calculating Dynamic Derivatives
Murman, Scott M.; [2005]; 9 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA; No Copyright; Avail: CASI; A02, Hardcopy

Computational Fluid Dynamics (CFD) is increasingly being used to both augment and create an aerodynamic performance database for aircraft configurations. This aerodynamic database contains the response of the aircraft to varying flight conditions and control surface deflections. The current work presents a novel method for calculating dynamic stability derivatives which reduces the computational cost over traditional unsteady CFD approaches by an order of magnitude, while still being applicable to arbitrarily complex geometries over a wide range of flow regimes. The primary thesis of this work is that the response to a forced motion can often be represented with a small, predictable number of frequency components without loss of accuracy. By resolving only those frequencies of interest, the computational effort is significantly reduced so that the routine calculation of dynamic derivatives becomes practical. The current implementation uses this same non-linear, frequency-domain approach and extends the application to the 3-D Euler equations. The current work uses a Cartesian, embedded-boundary method to automate the generation of dynamic stability derivatives.
Author (revised)
Computational Fluid Dynamics; Aerodynamic Characteristics; Dynamic Stability; Stability Derivatives; Frequency Domain Analysis

03
AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; airport ground operations; flight safety and hazards; and aircraft accidents. Systems and hardware specific to ground operations of aircraft and to airport construction are covered in *09 Research and Support Facilities (Air)*. Air traffic control is covered in *04 Aircraft Communications and Navigation*. For related information see also *16 Space Transportation and Safety* and *85 Technology Utilization and Surface Transportation*.

20040086114 Massachusetts Inst. of Tech., Cambridge, MA
Advanced Control Techniques for Control of Rotorcraft Vibration
Hall, Steven R.; Sep. 29, 2003; 41 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-01-1-0390
Report No.(s): AD-A424410; ARO-42454.2-EG; No Copyright; Avail: CASI; A03, Hardcopy

The goal of this project is to develop vibration and control approaches and software suitable for use in the flight tests of the MD-900 helicopter, and to assist Boeing in the preparations for flight test, to enable them to use our advanced control approaches. During this effort, we have studied the feasibility of improving the robustness of X-frame actuator systems using feedback control approaches. We have investigated various feedback control design techniques to find out whether it is feasible to make the actuator robust without sacrificing its performance, and concluded that the flap position control may not be required, and even more, may be counter-productive. We have also improved the system identification methodology to investigate periodic effects, and applied it to the flight test data at Langley. Our analysis of the Langley data shows that periodic effects are negligible, so that periodic control methods are probably not required for vibration control of active rotors. Finally, we have evaluated our advanced continuous-time control system approach to reduce the helicopter vibration using

wind tunnel test data at Langley, and found that our approach yields more than 20 dB of vibration reduction at the frequency components of interest.
DTIC
Control Systems Design; Flight Tests; Helicopters; Rotary Wing Aircraft; Rotary Wings; Vibration

20040086142 Air Force Flight Test Center, Edwards AFB, CA
Limited Evaluation of Sensor Requirements for Autonomous Air Refueling Rendezvous (Project Medium Rare)
Hague, Nick; Heesch, Darin; Orson, Jay; Peled-Lubitch, Ami; Warmka, Jeff; Dec. 2003; 92 pp.; In English
Report No.(s): AD-A424477; AFFTC-TIM-03-06; No Copyright; Avail: CASI; A05, Hardcopy

This report presents the results of Project MEDIUM RARE, a limited evaluation of sensor requirements for UAV autonomous air refueling rendezvous. The overall test objective was to determine sensor field-of-regard and detection range requirements for an array of tanker aspect angles that would allow successful autonomous, UAV rendezvous. The Air Force Research Laboratory requested this testing. The USAF Test Pilot School, Class 03A, conducted 8 flight test sorties totaling 12.5 hours at Edwards AFB, California, from 7 Oct to 28 Oct 03. All test objectives were met.
DTIC
Air to Air Refueling; Autonomy; Refueling

20040086207 Illinois Univ. at Urbana-Champaign, Urbana, IL
Beyond Precision: Issues of Morality and Decision Making in Minimizing Collateral Casualties
Roblyer, Dwight A.; Apr. 28, 2003; 44 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424627; No Copyright; Avail: CASI; A03, Hardcopy

This paper will analyze how the USA military currently endeavors as a moral agent to ‘do the right thing’ while preparing for air strikes. While the machines of air war can be further improved. Much of the moral burden of collateral casualties and damage falls on the military decision makers who employ them. Military members make or support many of the decisions about where, when, and how those machines will strike. These decisions often exist in the moral territory beyond the black-and-white bounds of legal standards where multiple right objectives compete for priority. This paper begins with a brief survey of the nature of undesired civilian death and injury resulting from wartime attacks from the air, and then examines the goals and the characteristics of air operations in Afghanistan in support of Operation Enduring Freedom (OEF). Following this is a review of the moral principles and legal standards that exist. against which the wartime actions of the USA are often compared. Next, the paper describes the process currently employed to plan air strikes, citing as primary sources the official doctrine, training, policy, and procedures used by the USA Air Force and the USA Central Command. which is the joint combatant command executing OEF. This process description is followed by considerations from the fields of applied ethics and decision analysis as they pertain to identifying possible issues in the decision support provided to military members who must make very difficult moral judgments in the targeting process. Finally. from this examination. The paper offers insights and recommendations to improve this moral decision support for military specialists and decision makers who work both to avoid unintended harm to innocents and to pursue national objectives.
DTIC
Casualties; Decision Making; Ethics; Warfare

20040086247 Air War Coll., Maxwell AFB, AL
A Search for Warriors: The Effects of Technology on the Air Force Ethos
Matthews, Mark T.; Apr. 1997; 60 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424693; AU/AWC/RWP118/97-04; No Copyright; Avail: CASI; A04, Hardcopy

The Air Force is changing. It has recently defined its mission as the defense of the USA through the control and exploitation of Air and Space. Indicative of this expanse into space is the establishment of a school to train all new Air Force officers in a common grounding of what it means to be an airman. This fundamental raison d’tre centers on the mission of strategic strike at the enemy’s heart. This mission will occur through the air and space medium. Airmen bring special expertise to those mediums. Whereas the Air Force combat mission formerly centered on pilots in manned combat aircraft, the Air Force has now expanded its definition of operators to any military or civilian member who is experienced in the employment and doctrine of air and space power. This re-embrace of the strategic strike mission into an expanded air and space environment acknowledges the concept that defined the Air Force as a separate service. This renaissance was prompted by an identity crisis fomented with the Soviet Union’s collapse and competition for scarce resources among the services as they increasingly duplicated each other’s capabilities. Technology will further de- emphasize the role of the Air Force combat pilot as the strike

mission moves into space. Yet one must wonder how quickly the Air Force will move into new technologies that will fundamentally change its warrior ethos. Societal, institution, and budgetary constraints will likely produce gradual change. The resultant danger lies in a creeping incrementalism that will destroy the Air Forces warrior culture, a culture critical to the effective combat employment of Air Force military power regardless of the means used. This paper concludes with recommendations on how to train future Air Force officers to maintain the Air Force warrior culture.
DTIC

20040086546 Massachusetts Inst. of Tech., Cambridge, MA, USA
Use of Structure as a Basis for Abstraction in Air Traffic Control
Davison, Hayley J.; Hansman, R. John; [2004]; 8 pp.; In English
Contract(s)/Grant(s): FAA-02-C-MIT-07; NAG2-1299; No Copyright; Avail: CASI; A02, Hardcopy

The safety and efficiency of the air traffic control domain is highly dependent on the capabilities and limitations of its human controllers. Past research has indicated that structure provided by the airspace and procedures could aid in simplifying the controllers cognitive tasks. In this paper, observations, interviews, voice command data analyses, and radar analyses were conducted at the Boston Terminal Route Control (TRACON) facility to determine if there was evidence of controllers using structure to simplify their cognitive processes. The data suggest that controllers do use structure-based abstractions to simplify their cognitive processes, particularly the projection task. How structure simplifies the projection task and the implications of understanding the benefits structure provides to the projection task was discussed.
Author
Air Traffic Control; Ground Based Control; Controllers; Safety; Mental Performance

20040086631 NASA Langley Research Center, Hampton, VA, USA
From Bridges and Rockets, Lessons for Software Systems
Holloway, C. Michael; [2004]; 10 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

Although differences exist between building software systems and building physical structures such as bridges and rockets, enough similarities exist that software engineers can learn lessons from failures in traditional engineering disciplines. This paper draws lessons from two well-known failures the collapse of the Tacoma Narrows Bridge in 1940 and the destruction of the space shuttle Challenger in 1986 and applies these lessons to software system development. The following specific applications are made: (1) the verification and validation of a software system should not be based on a single method, or a single style of methods; (2) the tendency to embrace the latest fad should be overcome; and (3) the introduction of software control into safety-critical systems should be done cautiously.
Author
Software Engineering; Program Verification (Computers)

20040086651 Federal Aviation Administration, Atlantic City, NJ, USA
Test and Evaluation Plan for the AS&E Backscatter X-ray System Evaluation
Snyder, M. D.; Mar. 2002; 22 pp.; In English
Report No.(s): PB2004-105259; DHS/TSA/TSL-04/15; No Copyright; Avail: CASI; A03, Hardcopy

The Transportation Security Human Factors and Behavioral Science Program will conduct a study that will evaluate whether or not an American Science and Engineering (AS&E) 101ZZ Plus backscatter X-ray machine with, a trained operator, can meet the Probability of Detection and Probability of False Alarm criteria published in the Explosive Detection System Certification Standard. In addition, Human Factors Engineers (HFEs) will record the time it takes participants to screen the test bag set in order to calculate throughput rate. Each of the participants will assess 360 bags. Seventy-two bags will contain an Improvised Explosive Device (IED) and 288 will be innocent bags.
NTIS
X Rays; Backscattering; Evaluation; Explosive Devices; Explosives Detection; System Effectiveness; Tests

20040086652 NASA Langley Research Center, Hampton, VA, USA
Non-Traditional Displays for Mission Monitoring
Trujillo, Anna C.; Schutte, Paul C.; December 1, 1999; 3 pp.; In English; ANS Conference, 1 Dec. 1999
Report No.(s): ANA Paper 056; No Copyright; Avail: CASI; A01, Hardcopy

Advances in automation capability and reliability have changed the role of humans from operating and controlling processes to simply monitoring them for anomalies. However, humans are traditionally bad monitors of highly reliable

systems over time. Thus, the human is assigned a task for which he is ill equipped. We believe that this has led to the dominance of human error in process control activities such as operating transportation systems (aircraft and trains), monitoring patient health in the medical industry, and controlling plant operations. Research has shown, though, that an automated monitor can assist humans in recognizing and dealing with failures. One possible solution to this predicament is to use a polar-star display that will show deviations from normal states based on parameters that are most indicative of mission health.
Author
Display Devices; Human Performance; Monitors; Reliability; Aeronautical Engineering; In-Flight Monitoring; Automation; Safety

20040086719 NASA Langley Research Center, Hampton, VA, USA
RF Coupling into the Fuel Tank of a Large Transport Aircraft from Intentionally Transmitting Peds in the Passenger Cabin
Nguyen, Truong X.; Dudley, Kenneth L.; Scearce, Stephen A.; Ely, Jay J.; Richardson, Robert E.; Hatfield, Michael O.; January 2004; 10 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

An investigation was performed to study the potential for radio frequency (RF) power radiated from Portable Electronic Devices (PEDs) to create an arcing/sparking event within the fuel tank of a large transport aircraft. This paper describes the experimental methods used for measuring RF coupling to the fuel tank and Fuel Quantity Indication System (FQIS) wiring from PED sources located in the passenger cabin. To allow comparison of voltage/current data obtained in a laboratory chamber FQIS installation to an actual aircraft FQIS installation, aircraft fuel tank RF reverberation characteristics were also measured. Results from the measurements, along with a survey of threats from typical intentional transmitting PEDs are presented. The resulting worst-case power coupled onto fuel tank FQIS wiring is derived. The same approach can be applied to measure RF coupling into various other aircraft systems.
Author
Electromagnetic Coupling; Fuel Tanks; Radio Frequencies; Aircraft Fuel Systems; Electronic Equipment; Sparks

20040086721 NASA Langley Research Center, Hampton, VA, USA
Development of a Wake Vortex Spacing System for Airport Capacity Enhancement and Delay Reduction
Hinton, David A.; OConnor, Cornelius J.; [2000]; 10 pp.; In English; 19th Digital Avionics Systems Conference, 7-13 Oct. 2000, Philadelphia, PA, USA
Report No.(s): Paper 3E6; No Copyright; Avail: CASI; A02, Hardcopy

The Terminal Area Productivity project has developed the technologies required (weather measurement, wake prediction, and wake measurement) to determine the aircraft spacing needed to prevent wake vortex encounters in various weather conditions. The system performs weather measurements, predicts bounds on wake vortex behavior in those conditions, derives safe wake spacing criteria, and validates the wake predictions with wake vortex measurements. System performance to date indicates that the potential runway arrival rate increase with Aircraft VOrtex Spacing System (AVOSS), considering common path effects and ATC delivery variance, is 5% to 12% depending on the ratio of large and heavy aircraft. The concept demonstration system, using early generation algorithms and minimal optimization, is performing the wake predictions with adequate robustness such that only 4 hard exceedances have been observed in 1235 wake validation cases. This performance demonstrates the feasibility of predicting wake behavior bounds with multiple uncertainties present, including the unknown aircraft weight and speed, weather persistence between the wake prediction and the observations, and the location of the weather sensors several kilometers from the approach location. A concept for the use of the AVOSS system for parallel runway operations has been suggested, and an initial study at the JFK International Airport suggests that a simplified AVOSS system can be successfully operated using only a single lidar as both the weather sensor and the wake validation instrument. Such a selfcontained AVOSS would be suitable for wake separation close to the airport, as is required for parallel approach concepts such as SOIA.
Derived from text
Air Traffic Control; Aircraft Approach Spacing; Aircraft Wakes; Vortex Advisory System; Vortex Avoidance; Aircraft Landing

20040086956 NASA Langley Research Center, Hampton, VA, USA
A Safety Index and Method for Flightdeck Evaluation
Latorella, Kara A.; [2000]; 6 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

If our goal is to improve safety through machine, interface, and training design, then we must define a metric of flightdeck

safety that is usable in the design process. Current measures associated with our notions of ‘good’ pilot performance and ultimate safety of flightdeck performance fail to provide an adequate index of safe flightdeck performance for design evaluation purposes. The goal of this research effort is to devise a safety index and method that allows us to evaluate flightdeck performance holistically and in a naturalistic experiment. This paper uses Reason’s model of accident causation (1990) as a basis for measuring safety, and proposes a relational database system and method for 1) defining a safety index of flightdeck performance, and 2) evaluating the ‘safety’ afforded by flightdeck performance for the purpose of design iteration. Methodological considerations, limitations, and benefits are discussed as well as extensions to this work.
Author
Aircraft Compartments; Aircraft Safety; Methodology; Pilot Performance

20040087230 Civil Aerospace Medical Inst., Oklahoma City, OK, USA
Automatic Dependent Surveillance: Broadcast/Cockpit Display of Traffic Information: Innovations in Aircraft Navigation on the Airport Surface
Prinzo, O. Veronika; July 2004; 18 pp.; In English
Contract(s)/Grant(s): FAA-AM-B-00-HRR-516
Report No.(s): DOT/FAA/AM-04/11; No Copyright; Avail: CASI; A03, Hardcopy

In 2000, the FAA’s Office of Runway Safety made a concerted effort to reduce runway incursions. The Safe Flight 21 Program awarded contracts for CDTI avionics development and an operational demonstration that included a surface moving-map capability. An operational evaluation was conducted in October 2000 to assess pilot use of varying types of CDTI devices and how surface-map information could aid pilot situation awareness when taxiing. Complex taxi routes were designed to examine how well pilots navigated heir aircraft using an electronic surface-map display (north-up, track-up) or a paper surface map. This study was designed to determine how the use of these displays might aid situational awareness and influence operational communications. Pilots navigated their aircraft during 3 day and 2 night operations, resulting in 31 structured and 37 unstructured taxi routes. As subject-matter experts listened to 15 hours of audiotapes and read verbatim transcripts, they identified operational concerns and noted problems. Communications involved in progressive taxi routes and routes instructing pilots to follow another aircraft were excluded from analysis. A Type-of-Route x Type-of-Map ANOVA revealed that more problems occurred for structured, compared with unstructured taxi routes, and more messages were exchanged. A statistically significant interaction indicated that most problems occurred for the north-up map during structured taxi routes, and the number of problems encountered was comparable for the other maps when pilots navigated along unstructured taxi routes. When designing electronic surface-map displays, providing a north-up map orientation appears to create more problems than either track-up or paper surface maps--especially when taxi routes are complex (or unfamiliar).
Author
Runways; Taxiing; Air Traffic Control; Cockpits; Display Devices; Situational Awareness; Maps

20040087352 Minnesota Univ., Minneapolis, MN, USA
Scales of Airport Expansion: Globalization, Regionalization, and Local Land Use
Cidell, J.; Jul. 2004; In English
Report No.(s): PB2004-106960; CTS 04-01; No Copyright; Avail: National Technical Information Service (NTIS)

This study examines two main issues surrounding the increasing demand for airport capacity: the effects of globalization and transportation on each other as expressed through local land use, and the politics of scale in struggles over airport expansion. The study centers around three case studies to illustrate how globalization, air transportation, and local land use are connected at the municipal, metropolitan, and regional levels. Each case study investigates a specific issue. The Minneapolis-St. Paul (MSP) case investigates the geographical distribution of economic impacts of the airport. The Chicago (ORD) case documents the changing land uses over time around OHare, as well as a detailed investigation of the current land use controversy in the vicinity of an expanding airport. The Boston (BOS) case study examines the regionally-based solution to airport demand, specifically the attempts to encourage passengers to use smaller regional airports in the area instead of the crowded Logan Airport in Boston.
NTIS
Airports; Air Transportation; Transportation

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance, and evaluation, and aircraft and flight simulation technology. For related information see also *18 Spacecraft Design, Testing and Performance*; and *39 Structural Mechanics*. For land transportation vehicles see *85 Technology Utilization and Surface Transportation*.

20040086106 Army War Coll., Carlisle Barracks, PA
The Achilles Heel of American Airpower
Leahy, Timothy J.; Mar. 19, 2004; 31 pp.; In English
Report No.(s): AD-A424395; No Copyright; Avail: CASI; A03, Hardcopy

The need to overcome an enemy's anti-access strategy and rapidly project lethal firepower anywhere in the world raises many policy issues about U.S. combat air search and rescue forces, not the least of which relate to the suitability of their aircraft fleet. This study asks whether the USA Air Force (USAF) should be satisfied with its helicopter-based combat search and rescue (CSAR) force for the indefinite future, or if it should make definite plans to replace these helicopters with aircraft that have greater speed, range, and survivability characteristics. The first part of this paper analyzes the foundation of the need to overcome an adversary's anti-access strategy. It looks at the National Security Strategy and the Quadrennial Defense Review to identify the goals that the services must build military forces and capabilities to support. It then looks at how the USAF has restructured itself to meet these goals in all but one critical area: CSAR. The analysis concludes that the U.S. requirement for airpower to react quickly over greater distances will impact the structure of tomorrow's CSAR forces. The second part of the paper analyzes the impact of speed, range, and survivability on the failure of the Iranian hostage rescue mission. This case study shows that the effects of speed, range, and survivability influence both the planning and probability of success of rescue missions. From a strict operational viewpoint, an aircraft that has increased speed, range, and survivability would be more flexible and capable in a CSAR mission. The final part of the paper asserts that the speed, range, and survivability characteristics of helicopters limit their ability to support an anti-access strategy. Therefore, other aircraft options should be looked at to fill this role. Ultimately, the most capable solution might require a mix of different aircraft, with different capabilities, to cover the entire spectrum of CSAR missions. (98 refs.)
DTIC
Helicopters; Rescue Operations

20040086128 Industrial Coll. of the Armed Forces, Washington, DC
Aircraft
Anderson, Jay; Bowman, Dan; Burke, Douglas; Campbell, Edward; Coble, Barry; Jan. 2002; 26 pp.; In English
Report No.(s): AD-A424435; No Copyright; Avail: CASI; A03, Hardcopy

The capabilities of the USA aircraft industry make it one of the essential foundations of the economic, political, and military elements of U.S. national power. Nevertheless, the events of 2001 significantly diminished the industry's vitality. Still leading U.S. business in export dollars, the industry has been forced to look for new markets as worldwide aircraft sales have dropped. Because the U.S. national security depends so heavily on this industry, the U.S. government provided support to weakened sectors - notably, the commercial air transport sector - that helped forestall a grave diminution of capability. As the U.S. economy emerges from the 2001 recession, so, too, will the aircraft industry begin to recover. In the meantime, the European aircraft market has experienced similar setbacks, but recent aircraft orders have restored vigor to their commercial transport sales. U.S. and European aircraft manufacturers continue to vie for market dominance, but only persist ill maintaining relative parity, even as they find increasing collaborations to be ill the interests of both. Given these circumstances, and without cooperative strategic planning by public and private organizations, the aircraft industry faces an uncertain future.
DTIC
Aircraft Industry

20040086141
Cooperative Control of Autonomous Flight Vehicles Formation
Innocenti, Mario; Mar. 29, 2004; 137 pp.; In English
Contract(s)/Grant(s): F61775-02-WE031
Report No.(s): AD-A424475; No Copyright; Avail: CASI; A07, Hardcopy

This report presents results from research dealing with the aspects of automated formation management and control necessary for the development of a dual controller capable of keeping a given formation structure and allowing the formation

to follow specified paths. The report contains two parts. Part I describes the results obtained, and methodologies developed, for the dynamics and control of unmanned air vehicles flying in a formation. Part II describes a fuzzy-set approach to the guidance and control management of these vehicles to establish conditions for successful target intercept. Chapter 1, Formation Flight Dynamic Modelling, focuses on Aerodynamic Modeling, including the Distributed Horse Shoe Vortex Technique, Induced Velocity Calculation, and Force and Moment Coefficients; and Formation Dynamics, including Modified Equations of Motion and Formation Kinematics. Chapter 2, Formation Flight Control, looks at the Natural Behavior of Migratory Birds, Formation Geometry Center, Inner-Loop Synthesis, Formation Controller Design, and Simulation Results. Chapter 3, Reconfiguration in the Presence of Communications Failures, examines Formation Flight Management; Optimal Communications, such as the Virtual Leader and Graph Theory Approach; Communications Failure, including Communication Topology Reconfiguration and the Broadcast Channel; and Aircraft Position Reconfiguration, including Aircraft Loss, Receiver Failure, and Failure Management during Aircraft Loss. Chapter 4, Stability of Gain Scheduling using Fuzzy Sets, focuses on Modeling and Control, Stability Analysis, and Case Studies. Chapter 5 examines a Guidance Methodology using Fuzzy Sets and Waypoints. Chapter 6 examines Aircraft Dynamics and Control Systems, Fuzzy Guidance System (FGS) Design and Simulation, Problems with the First FGS, the Second FGS Structure, and Management of Moving Waypoints. (62 figures, 35 refs.)
DTIC
Autonomy; Command Guidance; Drone Vehicles; Flight Control; Fuzzy Sets; Systems Management

20040086154 Air Force Flight Test Center, Edwards AFB, CA
An Investigation of Open Loop Flight Control Equations of Motion Used to Predict Flight Control Surface Deflections at Non-Steady State Trim Conditions (Project HAVE TRIM)
Miller, Gary D.; Beccarisi, Fabrizio; Teichert, E. J.; Higer, Matthew W.; Wenell, Peter A.; Dec. 2003; 184 pp.; In English
Report No.(s): AD-A424491; AFFTC-TIM-03-07; No Copyright; Avail: CASI; A09, Hardcopy

This report presents the results of Project HAVE TRIM, An Investigation of Open Loop Flight Control Equations of Motion Used To Predict Flight Control Surface Deflections at Non-Steady State Trim Conditions. The overall test objective was to validate the HAVE TRIM model through comparison of predicted control surface deflections with flight test measured control surface deflections at specified trimmed conditions. The USAF Test Pilot School, Class 03A, conducted 10 flights totaling 18.5 hours at Edwards AFB CA from 8 Oct to 17 Oct 03. All test objectives were met.
DTIC
Control Surfaces; Deflection; Equations of Motion; Flight Control; Steady State

20040086163 Naval Command, Control and Ocean Surveillance Center, San Diego, CA
On The Lookout: The Air Mobile Ground Security and Surveillance System (AMGSS) Has Arrived
Murphy, D. W.; Bott, J. P.; Jan. 1995; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424525; No Copyright; Avail: CASI; A03, Hardcopy

The Air Mobile Ground Security and Surveillance (AMGSSS) project has the objective of developing a system that can rapidly position remotely operated ground sensors at locations of operational interest and provide information obtained by those sensors back to the operator. AMGSSS exploits the capabilities of small, remotely operated, vertical-take-off-and-landing (VTOL) ducted fan aircraft to provide mobility to the sensor payload. These platforms can be operated effectively over the low-bandwidth tactical radio data-links required by military users.
DTIC
Payloads; Security; Surveillance; Vertical Takeoff Aircraft; Warning Systems

20040086179 Massachusetts Univ., Amherst, MA
Method for Knowledge-Based Helicopter Track and Balance
Danai, Kourosh; May 10, 2004; 40 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-00-1-0409
Report No.(s): AD-A424560; ARO-40144.3-EG; No Copyright; Avail: CASI; A03, Hardcopy

The aim of the project was to develop an efficient method of helicopter rotor tuning (track and balance) to cope with the potential nonlinearity of the process and to account for the vibration noise. Toward this goal, two methods have been developed. The first method relies on an interval model to represent the range of effect of blade adjustments on helicopter vibration and incorporates learning to adapt the coefficients of the interval model. The coefficients of the model are initially defined according to sensitivity coefficients between the blade adjustments and helicopter vibration, to include the a priori'

knowledge of the process These coefficients are subsequently transformed into intervals and updated after each tuning iteration to improve the model's estimation accuracy. The second method of rotor tuning uses a probability model to maximize the likelihood of success of the selected blade adjustments. The underlying model in this method consists of two segments: a linear segment to include the sensitivity coefficients between the blade adjustments and helicopter vibration, and a stochastic segment to represent the probability densities of the vibration components. Based on this model, the blade adjustments with the maximal probability of generating acceptable vibration are selected as recommended adjustments. The effectiveness of the two methods are evaluated in simulation using a series of neural networks trained with actual vibration data. The results indicate that the developed methods improve performance according to several criteria representing various aspects of track and balance.
DTIC
Helicopters; Mathematical Models; Rotary Wings; Tuning

20040086250 Naval Postgraduate School, Monterey, CA
An Analysis of the Integrated Mechanical Diagnostics Health and Usage Management System on Rotor Track and Balance
Revor, Mark S.; Jun. 2004; 102 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424698; No Copyright; Avail: CASI; A06, Hardcopy

This thesis is concerned with the operational benefit of the Integrated Mechanical Diagnostics Health and Usage Management Systems (IMD HUMS) rotor track and balance (RTB) functionality. The questions addressed are whether there is a savings in flight hours expended on functional check flights (FCF's) when compared to present practices, if there will there be a reduction in directed maintenance man-hours (DMMH) spent on maintenance related to the rotor system, and the impact on Operational Availability. Experiments were conducted using a discrete event simulation model of squadron flight operations and organizational level maintenance. The simulation is generic and can be used ill the analysis of other helicopters. Input parameters governing the distributions of maintenance action inter-arrival times were estimated from Naval Aviation Logistics Data Analysis (NALDA) databases and squadron experiences on such systems. The analysis suggests that flight hours spent in FCF are dependent upon vibration growth rate, an unknown quantity, and the maintenance policy for rotor smoothing. Directed maintenance man-hours decrease with increasing numbers of IMD HUMS configured aircraft and further gains are achieved with a maintenance policy suited to a continuous monitoring system.
DTIC
Aerodynamic Balance; Diagnosis; Health; Helicopters; Maintenance; Management Systems; Rotary Wings; Rotor Aerodynamics

20040086274 Naval Postgraduate School, Monterey, CA
Mission Tasking of Unmanned Vehicles
Johnson, Jada E.; Jun. 2004; 61 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424745; No Copyright; Avail: CASI; A04, Hardcopy

Unmanned vehicles (UVs) are expected to be an integral part of the U.S. Navy's expeditionary and carrier strike groups and are quickly being integrated into maritime operations. Command and control issues must be resolved, however, in order to utilize unmanned systems as intelligence, surveillance, and reconnaissance assets. The purpose of this research was to assess the current doctrine of mission tasking with respect to tactical unmanned vehicles (UVs) and determine a method for effectively tasking these systems. The problem was analyzed by applying the factors of METT-T: mission, enemy, terrain and weather, troops and support available, and time available to UV-enabled maritime missions. The analysis identified specific implications for unmanned vehicles and emphasized important considerations for tasking and allocating UVs. METT-T analyses generally result in courses of action, however, tasking is a command and control issue, and therefore, four organizational structures emerge for tasking UVs A significant finding of this study is that the current doctrinal framework of the composite warfare commander's concept can support tasking unmanned vehicles, but it requires revision to effectively address UV allocation issues.
DTIC
Drone Vehicles; Underwater Vehicles

20040086574 NASA Langley Research Center, Hampton, VA, USA
Active Control of Wind-Tunnel Model Aeroelastic Response Using Neural Networks
Scott, Robert C.; [March 2000]; 10 pp.; In English
Report No.(s): SPIE Paper 3991-30; No Copyright; Avail: CASI; A02, Hardcopy

NASA Langley Research Center, Hampton, VA 23681 Under a joint research and development effort conducted by the National Aeronautics and Space Administration and The Boeing Company (formerly McDonnell Douglas) three neural-network based control systems were developed and tested. The control systems were experimentally evaluated using a transonic wind-tunnel model in the Langley Transonic Dynamics Tunnel. One system used a neural network to schedule flutter suppression control laws, another employed a neural network in a predictive control scheme, and the third employed a neural network in an inverse model control scheme. All three of these control schemes successfully suppressed flutter to or near the limits of the testing apparatus, and represent the first experimental applications of neural networks to flutter suppression. This paper will summarize the findings of this project.
Author
Active Control; Wind Tunnel Models; Aeroelasticity; Network Control; Flutter Analysis

20040086579 NASA Langley Research Center, Hampton, VA, USA
Experimental Investigation of a Fullspan Tiltrotor Model with Higher-Harmonic Vibration Control
Piatak, David J.; Kunz, Donald L.; [1999]; 35 pp.; In English; Eighth ARO Workshop on Aeroelasticity of Rotorcraft Systems, 17-20 Oct. 1999, State College, PA, USA; No Copyright; Avail: CASI; A03, Hardcopy

The performance of a higher harmonic control system called the Multipoint Adaptive Vibration Suppression System (MAVSS) at reducing 3/rev wing vibratory loads and fuselage vibrations on a dynamically-scaled, fullspan, tiltrotor model is presented. Previous wind tunnel tests on a semispan aeroelastic tiltrotor model have demonstrated the effectiveness of MAVSS for reducing wing vibratory loads using both an active flaperon and swashplate. The primary goal, however, of such a vibration suppression system is to reduce tiltrotor fuselage vibrations in order to improve passenger comfort. The present study addresses the reduction of both wing and fuselage vibrations using simulated MAVSS active flaperons on a 1/10-scale dynamic tiltrotor model designed to be representative of a tiltrotor configuration. Also, this study attempts to identify possible problems that may impede the application of MAVSS flaperon control forces for the purpose of tiltrotor vibration reduction in the presence of fullspan symmetric and antisymmetric wing modes of vibration. Electromagnetic shakers applied simulated 3/rev vibratory hub loads and higher harmonic control forces, simulating active flaperons, to the tiltrotor model. MAVSS flaperon control forces are shown to be effective at reducing wing vibratory loads or fuselage vertical accelerations, but not as effective at reducing wing loads and fuselage vibrations simultaneously. Vibration reduction trends are shown to be a function of the simulated rotor speed for the fullspan configuration. These results suggest that the application of MAVSS-controlled flaperons to a tiltrotor configuration may prove to be difficult due to elevated wing vibratory loads during reduction of fuselage vibrations and because wing vibratory loads and fuselage vibrations cannot be reduced simultaneously.
Author
Tilt Rotor Aircraft; Harmonic Control; Dynamic Models

20040086665 NASA Langley Research Center, Hampton, VA, USA
A Practical Engineering Approach to Predicting Fatigue Crack Growth in Riveted Lap Joints
Harris, Charles E.; Piascik, Robert S.; Newman, James C., Jr.; [1999]; 21 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

An extensive experimental database has been assembled from very detailed teardown examinations of fatigue cracks found in rivet holes of fuselage structural components. Based on this experimental database, a comprehensive analysis methodology was developed to predict the onset of widespread fatigue damage in lap joints of fuselage structure. Several computer codes were developed with specialized capabilities to conduct the various analyses that make up the comprehensive methodology. Over the past several years, the authors have interrogated various aspects of the analysis methods to determine the degree of computational rigor required to produce numerical predictions with acceptable engineering accuracy. This study led to the formulation of a practical engineering approach to predicting fatigue crack growth in riveted lap joints. This paper describes the practical engineering approach and compares predictions with the results from several experimental studies.
Author
Cracks; Fatigue (Materials); Fuselages; Riveted Joints; Lap Joints; Structural Design

20040086680 NASA Langley Research Center, Hampton, VA, USA
Comparative Properties of Collaborative Optimization and other Approaches to MDO
Alexandrov, Natalia M.; Lewis, Robert Michael; [1999]; 8 pp.; In English; First ASMO UK/ISSMO CONFERENCE on Engineering Design Optimization, 8-9 Jul. 1999; No Copyright; Avail: CASI; A02, Hardcopy

We discuss criteria by which one can classify, analyze, and evaluate approaches to solving multidisciplinary design

optimization (MDO) problems. Central to our discussion is the often overlooked distinction between questions of formulating MDO problems and solving the resulting computational problem. We illustrate our general remarks by comparing several approaches to MDO that have been proposed.
Author
Formulations; Multidisciplinary Design Optimization; Algorithms; Dimensional Analysis

20040086694 NASA Langley Research Center, Hampton, VA, USA
Experiment Verification of the Analytical Methodology to Predict the Residual Strength of Metallic Shell Structure
Starnes, James H., Jr.; Ambur, Damodar R.; Young, Richard D.; Harris, Charles E.; [1999]; 4 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Experimental and analysis results for a curved, stiffened aluminum fuselage panel tested in a combined loads test machine with combined internal pressure, axial compression, and torsional shear loads are described. The experimental and analytical strain results for the panel with and without discrete source damage are presented. The effect of notch tip geometry on crack growth predictions is addressed. The crack growth trajectory predictions for the panel are presented for the applied loading conditions at failure.
Author
Fuselages; Aluminum; Curved Panels; Structural Analysis; Loads (Forces); Structural Failure; Crack Propagation; Failure Analysis

20040086695 NASA Langley Research Center, Hampton, VA, USA
In Search of the Physics: NASA's Approach to Airframe Noise
Macaraeg, Michele G.; Lockard, David P.; Streett, Craig L.; [1999]; 15 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

An extensive numerical and experimental study of airframe noise mechanisms associated with a subsonic high-lift system has been performed at NASA Langley Research Center (LaRC). Investigations involving both steady and unsteady computations and experiments on small-scale models with part-span flaps and full-span flaps are presented. Both surface (steady and unsteady pressure measurements, hot films, oil flows, pressure sensitive paint) and off-surface (5 holeprobe, particle-imaged velocimetry, laser velocimetry, laser light sheet measurements) were taken in the LaRC Quiet Flow Facility (QFF) and several hard-wall tunnels. Experiments in the Low Turbulence Pressure Tunnel (LTPT) included Reynolds number variations up to flight conditions. Successful microphone array measurements were also taken providing both acoustic source maps on the model, and quantitative spectra. Critical directivity measurements were obtained in the QFF. NASA Langley unstructured and structured Reynolds-Averaged Navier-Stokes codes modeled the steady aspects of the flows. Excellent comparisons with surface and off-surface experimental data were obtained. Subsequently, these meanflow calculations were utilized in both linear stability and direct numerical simulations of the flow fields to calculate unsteady surface pressures and farfield acoustic spectra. Accurate calculations were critical in obtaining not only noise source characteristics, but shear layer correction data as well. Techniques utilized in these investigations as well as brief overviews of the results are given.
Author
Airframes; Aircraft Noise; Noise Reduction; Aeroacoustics; Reynolds Number; Wing Flaps

20040086697 NASA Langley Research Center, Hampton, VA, USA
An Architecture for Real-Time Interpretation and Visualization of Structural Sensor Data in a Laboratory Environment
Doggett, William; Vazquez, Sixto; [2000]; 8 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

A visualization system is being developed out of the need to monitor, interpret, and make decisions based on the information from several thousand sensors during experimental testing to facilitate development and validation of structural health monitoring algorithms. As an added benefit the system will enable complete real-time sensor assessment of complex test specimens. Complex structural specimens are routinely tested that have hundreds or thousands of sensors. During a test, it is impossible for a single researcher to effectively monitor all the sensors and subsequently interesting phenomena occur that are not recognized until post-test analysis. The ability to detect and alert the researcher to these unexpected phenomena as the test progresses will significantly enhance the understanding and utilization of complex test articles. Utilization is increased by the ability to halt a test when the health monitoring algorithm response is not satisfactory or when an unexpected phenomenon occurs, enabling focused investigation potentially through the installation of additional sensors. Often if the test continues, structural changes make it impossible to reproduce the conditions that exhibited the phenomena. The prohibitive time and costs

associated with fabrication, sensoring, and subsequent testing of additional test articles generally makes it impossible to further investigate the phenomena. A scalable architecture is described to address the complex computational demands of structural health monitoring algorithm development and laboratory experimental test monitoring. The researcher monitors the test using a photographic quality 3D graphical model with actual sensor locations identified. In addition, researchers can quickly activate plots displaying time or load versus selected sensor response along with the expected values and predefined limits. The architecture has several key features. First, distributed dissimilar computers may be seamlessly integrated into the information flow. Second, virtual sensors may be defined that are complex functions of existing sensors or other virtual sensors. Virtual sensors represent a calculated value not directly measured by particular physical instrument. They can be used, for example, to represent the maximum difference in a range of sensors or the calculated buckling load based on the current strains. Third, the architecture enables autonomous response to preconceived events, where by the system can be configured to suspend or abort a test if a failure is detected in the load introduction system. Fourth, the architecture is designed to allow cooperative monitoring and control of the test progression from multiple stations both remote and local to the test system. To illustrate the architecture, a preliminary implementation is described monitoring the Stitched Composite Wing recently tested at LaRC.
Author
Real Time Operation; Structural Analysis; Multisensor Fusion; Imaging Techniques; Display Devices

20040086700 NASA Langley Research Center, Hampton, VA, USA
NASA's Subsonic Jet Transport Noise Reduction Research
Powell, Clemans A.; Preisser, John S.; [2000]; 10 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

Although new jet transport airplanes in today s fleet are considerably quieter than the first jet transports introduced about 40 years ago, airport community noise continues to be an important environmental issue. NASA s Advanced Subsonic Transport (AST) Noise Reduction program was begun in 1994 as a seven-year effort to develop technology to reduce jet transport noise 10 dB relative to 1992 technology. This program provides for reductions in engine source noise, improvements in nacelle acoustic treatments, reductions in the noise generated by the airframe, and improvements in the way airplanes are operated in the airport environs. These noise reduction efforts will terminate at the end of 2001 and it appears that the objective will be met. However, because of an anticipated 3-8% growth in passenger and cargo operations well into the 21st Century and the slow introduction of new the noise reduction technology into the fleet, world aircraft noise impact will remain essentially constant until about 2020 to 2030 and thereafter begin to rise. Therefore NASA has begun planning with the Federal Aviation Administration, industry, universities and environmental interest groups in the USA for a new noise reduction initiative to provide technology for significant further reductions.
Author
Jet Aircraft; Noise Reduction; Subsonic Speed; Aerodynamic Noise; Jet Aircraft Noise

20040086707 NASA Langley Research Center, Hampton, VA, USA
Damped Windows for Aircraft Interior Noise Control
Buehrle, Ralph D.; Klos, Jacob; Gibbs, Gary P.; [2004]; 12 pp.; In English; Noise-Con 2004, 12-14 Jul. 2004, Baltimore, MD, USA
Contract(s)/Grant(s): 23-781-10-13; No Copyright; Avail: CASI; A03, Hardcopy

Windows are a significant path for structure-borne and air-borne noise transmission into aircraft. To improve the acoustical performance, damped windows were fabricated using two or three layers of plexiglas with transparent viscoelastic damping material sandwiched between the layers. In this paper, numerical and experimental results are used to evaluate the acoustic benefits of damped windows. Tests were performed in the Structural Acoustic Loads and Transmission Facility at NASA Langley Research Center to measure the transmission loss for diffuse acoustic excitation and radiated sound power for point force excitation. Comparisons between uniform and damped plexiglas windows showed increased transmission loss of 6 dB at the first natural frequency, 6 dB at coincidence, and 4.5 dB over a 50 to 4k Hz range. Radiated sound power was reduced up to 7 dB at the lower natural frequencies and 3.7 dB over a 1000 Hz bandwidth. Numerical models are presented for the prediction of radiated sound power for point force excitation and transmission loss for diffuse acoustic excitation. Radiated sound power and transmission loss predictions are in good agreement with experimental data. A parametric study is presented that evaluates the optimum configuration of the damped plexiglas windows for reducing the radiated sound power.
Author
Acoustic Excitation; Acoustic Fatigue; Aircraft Noise; Fabrication; Polymethyl Methacrylate; Sound Transmission

20040086709 California Univ., Davis, CA, USA
Modeling and Design Analysis Methodology for Tailoring of Aircraft Structures with Composites
Rehfield, Lawrence W.; [2004]; 89 pp.; In English
Contract(s)/Grant(s): NAG1-01116; No Copyright; Avail: CASI; A05, Hardcopy

Composite materials provide design flexibility in that fiber placement and orientation can be specified and a variety of material forms and manufacturing processes are available. It is possible, therefore, to 'tailor' the structure to a high degree in order to meet specific design requirements in an optimum manner. Common industrial practices, however, have limited the choices designers make. One of the reasons for this is that there is a dearth of conceptual/preliminary design analysis tools specifically devoted to identifying structural concepts for composite airframe structures. Large scale finite element simulations are not suitable for such purposes. The present project has been devoted to creating modeling and design analysis methodology for use in the tailoring process of aircraft structures. Emphasis has been given to creating bend-twist elastic coupling in high aspect ratio wings or other lifting surfaces. The direction of our work was in concert with the overall NASA effort Twenty-First Century Aircraft Technology (TCAT). A multi-disciplinary team was assembled by Dr. Damodar Ambur to work on wing technology, which included our project.
Author
Aircraft Structures; Aircraft Design; Structural Design; Composite Materials; Design Analysis

20040086733 NASA Ames Research Center, Moffett Field, CA, USA, NASA Langley Research Center, Hampton, VA, USA, Boeing Co., Mesa, AZ, USA, Army Aviation Systems Command, Moffett Field, CA, USA
Overview of the Testing of a Small-Scale Proprotor
Young, Larry A.; Yamauchi, Gloria K.; Booth, Earl R., Jr.; Botha, Gavin; Dawson, Seth; [1999]; 12 pp.; In English; American Helicopter Society 55th Annual Forum, 25-27 May 1999, Montreal, Canada; Copyright; Avail: CASI; A03, Hardcopy

This paper presents an overview of results from the wind tunnel test of a 1/4-scale V-22 proprotor in the Duits-Nederlandse Windtunnel (DNW) in The Netherlands. The small-scale proprotor was tested on the isolated rotor configuration of the Tilt Rotor Aeroacoustic Model (TRAM). The test was conducted by a joint team from NASA Ames, NASA Langley, U.S. Army Aeroflightdynamics Directorate, and The Boeing Company. The objective of the test was to acquire a benchmark database for validating aeroacoustic analyses. Representative examples of airloads, acoustics, structural loads, and performance data are provided and discussed.
Author
Wind Tunnel Tests; V-22 Aircraft; Aerodynamic Loads; Flight Characteristics; Aeroacoustics

20040086736 Army Research Lab., Hampton, VA, USA
Hover Testing of the NASA/Army/MIT Active Twist Rotor Prototype Blade
Wilbur, Matthew L.; Yeager, William T., Jr.; Wilkie, W. Keats; Cesnik, Carlos E. S.; Shin, Sangloon; [2000]; 14 pp.; In English; American Helicopter Society 56th Annual Forum, 2-4 May 2000, Virginia Beach, VA, USA; Copyright; Avail: CASI; A03, Hardcopy

Helicopter rotor individual blade control promises to provide a mechanism for increased rotor performance and reduced rotorcraft vibrations and noise. Active material methods, such as piezoelectrically actuated trailing-edge flaps and strain-induced rotor blade twisting, provide a means of accomplishing individual blade control without the need for hydraulic power in the rotating system. Recent studies have indicated that controlled strain induced blade twisting can be attained using piezoelectric active fiber composite technology. In order to validate these findings experimentally, a cooperative effort between NASA Langley Research Center, the Army Research Laboratory, and the MIT Active Materials and Structures Laboratory has been developed. As a result of this collaboration an aeroelastically-scaled active-twist model rotor blade has been designed and fabricated for testing in the heavy gas environment of the Langley Transonic Dynamics Tunnel (TDT). The results of hover tests of the active-twist prototype blade are presented in this paper. Comparisons with applicable analytical predictions of active-twist frequency response in hovering flight are also presented.
Author
Hovering; Prototypes; Rotary Wing Aircraft; Transonic Wind Tunnels; Dynamic Models; Test Facilities; Active Control; Rotor Blades (Turbomachinery); Fabrication

20040086741 Sikorsky Aircraft, Stratford, CT, USA
A Variable Diameter Short Haul Civil Tiltrotor
Wang, James M.; Jones, Christopher T.; Nixon, Mark W.; [1999]; 8 pp.; In English; 55th Annual Forum of the American Helicopter Society, 25-27 May 1999, Montreal, Canada
Contract(s)/Grant(s): NAS1-20097; Copyright; Avail: CASI; A02, Hardcopy

The Short-Haul-Civil-tiltrotor (SHCT) component of the NASA Aviation System Capacity Program is an effort to develop the technologies needed for a potential 40-passenger civil tiltrotor. The variable diameter tiltrotor (VDTR) is a Sikorsky concept aimed at improving tiltrotor hover and cruise performance currently limited by disk loading that is much higher in hover than conventional helicopter, and much lower in cruise than turbo-prop systems. This paper describes the technical merits of using a VDTR on a SHCT aircraft. The focus will be the rotor design.
Author
Tilt Rotor Aircraft; Rotors; Design Analysis

20040086746 NASA Langley Research Center, Hampton, VA, USA
Piezoelectric Shunt Vibration Damping of F-15 Panel under High Acoustic Excitation
Wu, Shu-Yau; Turner, Travis L.; Rizzi, Stephen A.; SPIE Proceedings; [2000]; Volume 3989; 11 pp.; In English; 7th International Symposium on Smart Structures and Materials, 5-9 Mar. 2000, Newport Beach, CA, USA
Report No.(s): SPIE Paper 3989-7; No Copyright; Avail: CASI; A03, Hardcopy

At last year's SPIE symposium, we reported results of an experiment on structural vibration damping of an F-15 underbelly panel using piezoelectric shunting with five bonded PZT transducers. The panel vibration was induced with an acoustic speaker at an overall sound pressure level (OASPL) of about 90 dB. Amplitude reductions of 13.45 and 10.72 dB were achieved for the first and second modes, respectively, using single- and multiple-mode shunting. It is the purpose of this investigation to extend the passive piezoelectric shunt-damping technique to control structural vibration induced at higher acoustic excitation levels, and to examine the controllability and survivability of the bonded PZT transducers at these high levels. The shunting experiment was performed with the Thermal Acoustic Fatigue Apparatus (TAFA) at the NASA Langley Research Center using the same F-15 underbelly panel. The TAFA is a progressive wave tube facility. The panel was mounted in one wall of the TAFA test section using a specially designed mounting fixture such that the panel was subjected to grazing-incidence acoustic excitation. Five PZT transducers were used with two shunt circuits designed to control the first and second modes of the structure between 200 and 400 Hz. We first determined the values of the shunt inductance and resistance at an OASPL of 130 dB. These values were maintained while we gradually increased the OASPL from 130 to 154 dB in 6-dB steps. During each increment, the frequency response function between accelerometers on the panel and the acoustic excitation measured by microphones, before and after shunting, were recorded. Good response reduction was observed up to the 148dB level. The experiment was stopped at 154 dB due to wire breakage from vibration at a transducer wire joint. The PZT transducers, however, were still bonded well on the panel and survived at this high dB level. We also observed shifting of the frequency peaks toward lower frequency when the OASPL was increased. Detailed experimental results will be presented.
Author
F-15 Aircraft; Vibration Damping; Piezoelectricity; Panels; Structural Vibration; Acoustic Excitation

20040086754 NASA Langley Research Center, Hampton, VA, USA
Two-Dimensional Fourier Transform Analysis of Helicopter Flyover Noise
SantaMaria, Odilyn L.; Farassat, F.; Morris, Philip J.; [1999]; 17 pp.; In English; American Helicopter Society 55th Annual Forum, 25-27 May 1999, Montreal, Canada
Contract(s)/Grant(s): NCCW-0076; No Copyright; Avail: CASI; A03, Hardcopy

A method to separate main rotor and tail rotor noise from a helicopter in flight is explored. Being the sum of two periodic signals of disproportionate, or incommensurate frequencies, helicopter noise is neither periodic nor stationary. The single Fourier transform divides signal energy into frequency bins of equal size. Incommensurate frequencies are therefore not adequately represented by any one chosen data block size. A two-dimensional Fourier analysis method is used to separate main rotor and tail rotor noise. The two-dimensional spectral analysis method is first applied to simulated signals. This initial analysis gives an idea of the characteristics of the two-dimensional autocorrelations and spectra. Data from a helicopter flight test is analyzed in two dimensions. The test aircraft are a Boeing MD902 Explorer (no tail rotor) and a Sikorsky S-76 (4-bladed tail rotor). The results show that the main rotor and tail rotor signals can indeed be separated in the two-dimensional Fourier transform spectrum. The separation occurs along the diagonals associated with the frequencies of interest. These diagonals are individual spectra containing only information related to one particular frequency.
Author
Aeroacoustics; Aerodynamic Noise; Aircraft Noise; Rotor Aerodynamics

20040086755 NASA Langley Research Center, Hampton, VA, USA
Advanced Aerodynamic Control Effectors
Wood, Richard M.; Bauer, Steven X. S.; [1999]; 13 pp.; In English
Report No.(s): Rept-1999-01-5619; No Copyright; Avail: CASI; A03, Hardcopy

A 1990 research program that focused on the development of advanced aerodynamic control effectors (AACE) for military aircraft has been reviewed and summarized. Data are presented for advanced planform, flow control, and surface contouring technologies. The data show significant increases in lift, reductions in drag, and increased control power, compared to typical aerodynamic designs. The results presented also highlighted the importance of planform selection in the design of a control effector suite. Planform data showed that dramatic increases in lift (greater than 25%) can be achieved with multiple wings and a sawtooth forebody. Passive porosity and micro drag generator control effector data showed control power levels exceeding that available from typical effectors (moving surfaces). Application of an advanced planform to a tailless concept showed benefits of similar magnitude as those observed in the generic studies.
Author
Control Surfaces; Effectors; Military Aircraft; Aerodynamic Configurations

20040086758 Milan Univ., Italy
Multi-Body Analysis of the 1/5 Scale Wind Tunnel Model of the V-22 Tiltrotor
Ghiringhelli, G. L.; Masarati, P.; Mantegazza, P.; Nixon, M. W.; [1999]; 10 pp.; In English; American Helicopter Society 55th Annual FOrum, 25-27 May 1999, Montreal, Quebec, Canada; Copyright; Avail: CASI; A02, Hardcopy
The paper presents a multi-body analysis of the 1/5 scale wind tunnel model of the V-22 tiltrotor, the Wing and Rotor Aeroelastic Testing System (WRATS), currently tested at NASA Langley Research Center. An original multi-body formulation has been developed at the Dipartimento di Ingegneria Aerospaziale of the Politecnico di Milano, Italy. It is based on the direct writing of the equilibrium equations of independent rigid bodies, connected by kinematic constraints that result in the addition of algebraic constraint equations, and by dynamic constraints, that directly contribute to the equilibrium equations. The formulation has been extended to the simultaneous solution of interdisciplinary problems by modeling electric and hydraulic networks, for aeroservoelastic problems. The code has been tailored to the modeling of rotorcrafts while preserving a complete generality. A family of aerodynamic elements has been introduced to model high aspect aerodynamic surfaces, based on the strip theory, with quasi-steady aerodynamic coefficients, compressibility, post-stall interpolation of experimental data, dynamic stall modeling, and radial flow drag. Different models for the induced velocity of the rotor can be used, from uniform velocity to dynamic in flow. A complete dynamic and aeroelastic analysis of the model of the V-22 tiltrotor has been performed, to assess the validity of the formulation and to exploit the unique features of multi-body analysis with respect to conventional comprehensive rotorcraft codes; These are the ability to model the exact kinematics of mechanical systems, and the possibility to simulate unusual maneuvers and unusual flight conditions, that are particular to the tiltrotor, e.g. the conversion maneuver. A complete modal validation of the analytical model has been performed, to assess the ability to reproduce the correct dynamics of the system with a relatively coarse beam model of the semispan wing, pylon and rotor. Particular care has been used to model the kinematics of the gimbal joint, that characterizes the rotor hub, and of the control system, consisting in the entire swashplate mechanism. The kinematics of the fixed and the rotating plates have been modeled, with variable length control links used to input the controls, the rotating flexible links, the pitch horns and the pitch bearings. The investigations took advantage of concurring wind tunnel test runs, that were performed in August 1998, and allowed the acquisition of data specific to the multi-body analysis.
Author
Wind Tunnel Models; V-22 Aircraft; Dynamic Structural Analysis; Wind Tunnel Tests

20040086759 Army Research Lab., Hampton, VA, USA
Aeroelastic Analysis of the NASA/ARMY/MIT Active Twist Rotor
Wilkie, W. Keats; Wilbur, Matthew L.; Mirick, Paul H.; Cesnik, Carlos E. S.; Shin, Sangloon; [1999]; 10 pp.; In English; American Helicopter Society 55th Annual Forum, 25-27 May 1999, Montreal, Canada; No Copyright; Avail: CASI; A02, Hardcopy
Aeroelastic modeling procedures used in the design of a piezoelectric controllable twist helicopter rotor wind tunnel model are described. Two aeroelastic analysis methods developed for active twist rotor studies, and used in the design of the model blade, are described in this paper. The first procedure uses a simple flap-torsion dynamic representation of the active twist blade, and is intended for rapid and efficient control law and design optimization studies. The second technique employs a commercially available comprehensive rotor analysis package, and is used for more detailed analytical studies. Analytical predictions of hovering flight twist actuation frequency responses are presented for both techniques. Forward flight fixed system nP vibration suppression capabilities of the model active twist rotor system are also presented. Frequency responses predicted using both analytical procedures agree qualitatively for all design cases considered, with best correlation for cases where uniform blade properties are assumed.
Author
Aeroelasticity; Wind Tunnel Models; Piezoelectricity; Prediction Analysis Techniques; Control Theory; Rotary Wings

20040086766 NASA Langley Research Center, Hampton, VA, USA
DARPA/AFRL/NASA Smart Wing Second Wind Tunnel Test Results
Scherer, L. B.; Martin, C. A.; West, M.; Florance, J. P.; Wieseman, C. D.; Burner, A. W.; Fleming, G. A.; [2001]; 11 pp.; In English
Contract(s)/Grant(s): F33615-93-C-3202; Copyright; Avail: CASI; A03, Hardcopy

To quantify the benefits of smart materials and structures adaptive wing technology, Northrop Grumman Corp. (NGC) built and tested two 16% scale wind tunnel models (a conventional and a 'smart' model) of a fighter/attack aircraft under the DARPA/AFRL/NASA Smart Materials and Structures Development - Smart Wing Phase 1. Performance gains quantified included increased pitching moment (C(sub M)), increased rolling moment (C(subl)) and improved pressure distribution. The benefits were obtained for hingeless, contoured trailing edge control surfaces with embedded shape memory alloy (SMA) wires and spanwise wing twist effected by SMA torque tube mechanisms, compared to conventional hinged control surfaces. This paper presents an overview of the results from the second wind tunnel test performed at the NASA Langley Research Center s (LaRC) 16ft Transonic Dynamic Tunnel (TDT) in June 1998. Successful results obtained were: 1) 5 degrees of spanwise twist and 8-12% increase in rolling moment utilizing a single SMA torque tube, 2) 12 degrees of deflection, and 10% increase in rolling moment due to hingeless, contoured aileron, and 3) demonstration of optical techniques for measuring spanwise twist and deflected shape.
Author
Aircraft Models; Control Surfaces; Fighter Aircraft; Scale Models

20040086768 NASA Langley Research Center, Hampton, VA, USA
Airbreathing Hypersonic Vision-Operational-Vehicles Design Matrix
Hunt, James L.; Pegg, Robert J.; Petley, Dennis H.; [1999]; 11 pp.; In English
Report No.(s): Rept-1999-01-5515; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents the status of the airbreathing hypersonic airplane and space-access vision-operational-vehicle design matrix, with emphasis on horizontal takeoff and landing systems being studied at Langley; it reflects the synergies and issues, and indicates the thrust of the effort to resolve the design matrix including Mach 5 to 10 airplanes with global-reach potential, pop-up and dual-role transatmospheric vehicles and airbreathing launch systems. The convergence of several critical systems/technologies across the vehicle matrix is indicated. This is particularly true for the low speed propulsion system for large unassisted horizontal takeoff vehicles which favor turbines and/or perhaps pulse detonation engines that do not require LOX which imposes loading concerns and mission flexibility restraints.
Author
Air Breathing Engines; Aircraft Launching Devices; Hypersonic Vehicles; Transatmospheric Vehicles; Aerothermodynamics; Systems Engineering

20040086779 NASA Langley Research Center, Hampton, VA, USA
NASA/ARMY/BELL XV-15 Tiltrotor Low Noise Terminal Area Operations Flight Research Program
Conner, David A.; Edwards, Bryan D.; Decker, William A.; Marcolini, Michael A.; Klein, Peter D.; [2000]; 23 pp.; In English
Report No.(s): AIAA Paper 2000-1923; Copyright; Avail: CASI; A03, Hardcopy

A series of three XV-15 acoustic flight tests have been conducted over a five year period by a NASA/Army/Bell Helicopter team to evaluate the noise reduction potential for tiltrotor aircraft during terminal area operations. Lower hemispherical noise characteristics for a wide range of steady-state terminal area type operating conditions were measured during the phase 1 test and indicated that the takeoff and level flight conditions were not significant contributors to the total noise of tiltrotor operations. Phase 1 results were used to design low noise approach profiles that were tested during the phase 2 and phase 3 tests, which used large area microphone arrays to directly measure the ground noise footprints. Approach profile designs emphasized noise reduction while maintaining handling qualities sufficient for tiltrotor commercial passenger ride comfort and flight safety under Instrument Flight Rules (IFR) conditions. This paper will discuss the weather, aircraft, tracking, guidance, and acoustic instrumentation systems, as well as the approach profile design philosophy, and the overall test program philosophy. Acoustic results are presented documenting the variation in tiltrotor noise due to changes in operating condition, indicating the potential for significant noise reduction using the unique tiltrotor capability of nacelle tilt.
Author
Noise Reduction; Tilt Rotor Aircraft; Xv-15 Aircraft; Acoustics; Noise Measurement; Flight Tests

20040086781 NASA Langley Research Center, Hampton, VA, USA

Multidisciplinary Aerodynamic-Structural Shape Optimization Using Deformation (MASSOUD)

Samareh, Jamshid A.; [2000]; 12 pp.; In English; 8th AIAA/NASA/USAF/ISSMO Symposium on Multidisciplinary Analysis and Optimization, 6-8 Sep. 2000, Long Beach, CA, USA

Report No.(s): AIAA Paper 2000-4911; Copyright; Avail: CASI; A03, Hardcopy

This paper presents a multidisciplinary shape parameterization approach. The approach consists of two basic concepts: (1) parameterizing the shape perturbations rather than the geometry itself and (2) performing the shape deformation by means of the soft object animation algorithms used in computer graphics. Because the formulation presented in this paper is independent of grid topology, we can treat computational fluid dynamics and finite element grids in the same manner. The proposed approach is simple, compact, and efficient. Also, the analytical sensitivity derivatives are easily computed for use in a gradient-based optimization. This algorithm is suitable for low-fidelity (e.g., linear aerodynamics and equivalent laminate plate structures) and high-fidelity (e.g., nonlinear computational fluid dynamics and detailed finite element modeling) analysis tools. This paper contains the implementation details of parameterizing for planform, twist, dihedral, thickness, camber, and free-form surface. Results are presented for a multidisciplinary application consisting of nonlinear computational fluid dynamics, detailed computational structural mechanics, and a simple performance module.

Author

Multidisciplinary Design Optimization; Shape Optimization; Aerodynamic Configurations; Computational Fluid Dynamics; Finite Element Method; Parameterization; Planforms; Deformation; Computer Animation

20040086794 NASA Langley Research Center, Hampton, VA, USA

Nontangent, Developed Contour Bulkheads for a Wing-Body Single Stage Launch Vehicle

Wu, K. Chauncey; Lepsch, Roger A., Jr.; [1999]; 16 pp.; In English; 37th AIAA Aerospace Sciences Meeting and Exhibit, 11-14 Jan. 1999, Reno, NV, USA

Report No.(s): AIAA Paper 99-0835; Copyright; Avail: CASI; A03, Hardcopy

Dry weights for a SSTO vehicle which incorporates nontangent, developed contour bulkheads are estimated and compared to a baseline vehicle with 1.41 4 aspect ratio ellipsoidal bulkheads, Weights, volumes and heights of optimized bulkhead designs are computed using a preliminary design bulkhead analysis code. The dry weight of a vehicle which incorporates the optimized bulkheads is predicted using a vehicle weights and sizing code. Two optimization approaches are employed. A structural-level method, where the vehicle s three major bulkhead regions are optimized separately and then incorporated into a model for computation of the vehicle dry weight, predicts a reduction of 4365 Ib (2.2 percent) from the 200,679 Ib baseline vehicle dry weight. In the second, vehicle-level, approach, the vehicle dry weight is the objective function for the optimization. During the vehicle- level analysis, modified bulkhead designs are first analyzed, then incorporated into the weights model for computation of a dry weight. The optimizer simultaneously manipulates design variables for all three bulkheads to reduce the dry weight. The vehicle-level analysis predicts a dry weight reduction of 5129 Ib, a 2.6 percent reduction from the baseline value. These results suggest that nontangent, developed contour bulkheads may provide substantial weight savings for SSTO vehicles.

Author

Single Stage to Orbit Vehicles; Body-Wing Configurations; Bulkheads; Contours

20040086795 NASA Langley Research Center, Hampton, VA, USA

Oscillatory Excitation of Unsteady Compressible Flows over Airfoils at Flight Reynolds Numbers

Seifert, Avi; Pack, LaTunia G.; [1999]; 16 pp.; In English; 37th AIAA Aerospace Sciences Meeting and Exhibit, 11-14 Jan. 1999, Reno, NV, USA

Report No.(s): AIAA Paper 99-0925; Copyright; Avail: CASI; A03, Hardcopy

An experimental investigation, aimed at delaying flow separation due to the occurrence of a shock-wave-boundary-layer interaction, is reported. The experiment was performed using a NACA 0012 airfoil and a NACA 0015 airfoil at high Reynolds number incompressible and compressible flow conditions. The effects of Mach and Reynolds numbers were identified, using the capabilities of the cryogenic-pressurized facility to maintain one parameter fixed and change the other. Significant Reynolds number effects were identified in the baseline compressible flow conditions even at Reynolds number of 10 and 20 million. The main objectives of the experiment were to study the effects of periodic excitation on airfoil drag-divergence and to alleviate the severe unsteadiness associated with shock-induced separation (known as ‘buffeting"). Zero-mass-flux oscillatory blowing was introduced through a downstream directed slot located at 10% chord on the upper surface of the NACA 0015 airfoil. The effective frequencies generated 2-4 vortices over the separated region, regardless of the Mach number. Even though the excitation was introduced upstream of the shock-wave, due to experimental limitations, it had pronounced

effects downstream of it. Wake deficit (associated with drag) and unsteadiness (associated with buffeting) were significantly reduced. The spectral content of the wake pressure fluctuations indicates of steadier flow throughout the frequency range when excitation was applied. This is especially important at low frequencies which are more likely to interact with the airframe.
Author
Boundary Layer Separation; Airframes; Unsteady Flow; Shock Layers; Airfoils; High Reynolds Number; Frequency Ranges; Compressible Flow

20040086796 NASA Langley Research Center, Hampton, VA, USA
Subsonic Static and Dynamic Aerodynamics of Blunt Entry Vehicles
Mitcheltree, Robert A.; Fremaux, Charles M.; Yates, Leslie A.; [1999]; 10 pp.; In English; 37th Aerospace Sciences Meeting and Exhibit, 11-14 Jan. 1999, Reno, NV, USA
Report No.(s): AIAA Paper 99-1020; Copyright; Avail: CASI; A02, Hardcopy

The incompressible subsonic aerodynamics of four entry-vehicle shapes with variable c.g. locations are examined in the Langley 20-Foot Vertical Spin Tunnel. The shapes examined are spherically-blunted cones with half-cone angles of 30, 45, and 60 deg. The nose bluntness varies between 0.25 and 0.5 times the base diameter. The Reynolds number based on model diameter for these tests is near 500,000. Quantitative data on attitude and location are collected using a video-based data acquisition system and reduced with a six deg-of-freedom inverse method. All of the shapes examined suffered from strong dynamic instabilities which could produced limit cycles with sufficient amplitudes to overcome static stability of the configuration. Increasing cone half-angle or nose bluntness increases drag but decreases static and dynamic stability.
Author
Blunt Bodies; Aerodynamic Configurations; Aerospace Vehicles; Subsonic Speed; Wind Tunnel Tests; Static Stability; Dynamic Models

20040086814 NASA Langley Research Center, Hampton, VA, USA
Airframe Integration Trade Studies for a Reusable Launch Vehicle
Dorsey, John T.; Wu, Chauncey; Rivers, Kevin; Martin, Carl; Smith, Russell; [1999]; 14 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Future launch vehicles must be lightweight, fully reusable and easily maintained if low-cost access to space is to be achieved. The goal of achieving an economically viable Single-Stage-to-Orbit (SSTO) Reusable Launch Vehicle (RLV) is not easily achieved and success will depend to a large extent on having an integrated and optimized total system. A series of trade studies were performed to meet three objectives. First, to provide structural weights and parametric weight equations as inputs to configuration-level trade studies. Second, to identify, assess and quantify major weight drivers for the RLV airframe. Third, using information on major weight drivers, and considering the RLV as an integrated thermal structure (composed of thrust structures, tanks, thermal protection system, insulation and control surfaces), identify and assess new and innovative approaches or concepts that have the potential for either reducing airframe weight, improving operability, and/or reducing cost.
Author
Airframes; Cost Reduction; Reusable Launch Vehicles; Weight Reduction

20040086820 NASA Langley Research Center, Hampton, VA, USA
Sensitivity of Lumped Constraints Using the Adjoint Method
Akgun, Mehmet A.; Haftka, Raphael T.; Wu, K. Chauncey; Walsh, Joanne L.; [1999]; 12 pp.; In English; 40th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 12-15 Apr. 1999, Saint Louis, MO, USA
Contract(s)/Grant(s): NCC1-268
Report No.(s): AIAA Paper 99-1314; Copyright; Avail: CASI; A03, Hardcopy

Adjoint sensitivity calculation of stress, buckling and displacement constraints may be much less expensive than direct sensitivity calculation when the number of load cases is large. Adjoint stress and displacement sensitivities are available in the literature. Expressions for local buckling sensitivity of isotropic plate elements are derived in this study. Computational efficiency of the adjoint method is sensitive to the number of constraints and, therefore, the method benefits from constraint lumping. A continuum version of the Kreisselmeier-Steinhauser (KS) function is chosen to lump constraints. The adjoint and direct methods are compared for three examples: a truss structure, a simple HSCT wing model, and a large HSCT model. These sensitivity derivatives are then used in optimization.
Author
Buckling; Loads (Forces); Isotropy; Lumping; Displacement

20040086836 NASA Langley Research Center, Hampton, VA, USA

Contributions to Active Buffeting Alleviation Programs by the NASA Langley Research Center

Moses, Robert W.; [1999]; 9 pp.; In English

Report No.(s): AIAA Paper 99-1318; Copyright; Avail: CASI; A02, Hardcopy

Buffeting is an aeroelastic phenomenon which plagues high performance aircraft, especially those with twin vertical tails like the F/A-18, at high angles of attack. This buffeting is a concern from fatigue and inspection points of view. By means of wind-tunnel and flight tests, this phenomenon is well studied to the point that buffet loads can be estimated and fatigue life can be increased by structural enhancements to the airframe. In more recent years, buffeting alleviation through active control of smart materials has been highly researched in wind-tunnel proof-of-concept demonstrations and full-scale ground tests using the F/A-18 as a test bed. Because the F/A-18 resides in fleets outside as well as inside the USA, these tests have evolved into international collaborative research activities with Australia and Canada, coordinated by the Air Force Research Laboratory (AFRL) and conducted under the auspices of The Technical Cooperation Program (TTCP). With the recent successes and advances in smart materials, the main focus of these buffeting alleviation tests has also evolved to a new level: utilize the F/A-18 as a prototype to mature smart materials for suppressing vibrations of aerospace structures. The role of the NASA Langley Research Center (LaRC) in these programs is presented.

Author

Buffeting; F-18 Aircraft; Aeroelasticity; Active Control; Flight Tests

20040086840 NASA Langley Research Center, Hampton, VA, USA

Effect of Directional Array Size on the Measurement of Airframe Noise Components

Brooks, Thomas F.; Humphreys, William M., Jr.; [1999]; 21 pp.; In English; Fifth AIAA/CEAS Aeroacoustics Conference, 10-12 May 1999, Bellevue, WA, USA

Report No.(s): AIAA Paper 99-1958; Copyright; Avail: CASI; A03, Hardcopy

A study was conducted to examine the effects of overall size of directional (or phased) arrays on the measurement of aeroacoustic components. An airframe model was mounted in the potential core of an open-jet windtunnel, with the directional arrays located outside the flow in an anechoic environment. Two array systems were used; one with a solid measurement angle that encompasses 31.6 deg.of source directivity and a smaller one that encompasses 7.2 deg. The arrays, and sub-arrays of various sizes, measured noise from a calibrator source and flap edge model setups. In these cases, noise was emitted from relatively small, but finite size source regions, with intense levels compared to other sources. Although the larger arrays revealed much more source region detail, the measured source levels were substantially reduced due to finer resolution compared to that of the smaller arrays. To better understand the measurements quantitatively, an analytical model was used to define the basic relationships between array to source region sizes and measured output level. Also, the effect of noise scattering by shear layer turbulence was examined using the present data and those of previous studies. Taken together, the two effects were sufficient to explain spectral level differences between arrays of different sizes. An important result of this study is that total (integrated) noise source levels are retrievable and the levels are independent of the array size as long as certain experimental and processing criteria are met. The criteria for both open and closed tunnels are discussed. The success of special purpose diagonal-removal processing in obtaining integrated results is apparently dependent in part on source distribution. Also discussed is the fact that extended sources are subject to substantial measurement error, especially for large arrays.

Author

Acoustic Properties; Aeroacoustics; Aerodynamic Noise; Aircraft Noise; Noise Measurement

20040086842 NASA Langley Research Center, Hampton, VA, USA

An Elasticity-Based Mesh Scheme Applied to the Computation of Unsteady Three-Dimensional Spoiler and Aeroelastic Problems

Bartels, Robert E.; [1999]; 11 pp.; In English

Report No.(s): AIAA Paper 99-3301; Copyright; Avail: CASI; A03, Hardcopy

This paper presents a modification of the spring analogy scheme which uses axial linear spring stiffness with selective spring stiffening/relaxation. An alternate approach to solving the geometric conservation law is taken which eliminates the need for storage of metric Jacobians at previous time steps. Efficiency and verification are illustrated with several unsteady 2-D airfoil Euler computations. The method is next applied to the computation of the turbulent flow about a 2-D airfoil and wing with two and three- dimensional moving spoiler surfaces, and the results compared with Benchmark Active Controls Technology (BACT) experimental data. The aeroelastic response at low dynamic pressure of an airfoil to a single large scale oscillation of a spoiler surface is computed. This study confirms that it is possible to achieve accurate solutions with a very

large time step for aeroelastic problems using the fluid solver and aeroelastic integrator as discussed in this paper.
Author
Aeroelasticity; Airfoils; Dynamic Response; Elastic Properties; Stiffness; Wings; Spoilers

20040086844 NASA Langley Research Center, Hampton, VA, USA
Simultaneous Aerodynamic Analysis and Design Optimization (SAADO) for a 3-D Rigid Wing
Gumbert, Clyde R.; Hou, Gene J.-W.; Newman, Perry A.; [1999]; 17 pp.; In English
Contract(s)/Grant(s): NAS1-19858
Report No.(s): AIAA Paper 99-3296; Copyright; Avail: CASI; A03, Hardcopy

The formulation and implementation of an optimization method called Simultaneous Aerodynamic Analysis and Design Optimization (SAADO) is presented and applied to a simple 3D wing problem. The method aims to reduce the computational expense incurred in performing shape optimization using state-of-the-art CFD flow analysis and sensitivity analysis tools. Results for this small problem show that the method reaches the same local optimum as conventional optimization methods and does so in about half the computational time.
Author
Aerodynamic Characteristics; Design Analysis; Wings; Three Dimensional Models

20040086846 NASA Langley Research Center, Hampton, VA, USA
A Gas-Actuated Projectile Launcher for High-Energy Impact Testing of Structures
Ambur, Damodar R.; Jaunky, Navin; Lawson, Robin E.; Knight, Norman F., Jr.; Lyle, Karen H.; [1999]; 12 pp.; In English; AIAA/ASME/ASCE/AHS/ASC 40th Structures, Structural Dynamics, and Materials Conference, 12-15 Apr. 2004, Saint Louis, MO, USA
Report No.(s): AIAA Paper 99-1385; Copyright; Avail: CASI; A03, Hardcopy

A gas-act,uated penetration device has been developed for high-energy impact testing of structures. The high-energy impact. t,estiiig is for experimental simulation of uncontained engine failures. The non-linear transient finite element, code LS-DYNA3D has been used in the numerical simula.tions of a titanium rectangular blade with a.n aluminum target, plate. Threshold velocities for different combinations of pitch and yaw angles of the impactor were obtained for the impactor-target, t8est configuration in the numerica.1 simulations. Complet,e penet,ration of the target plate was also simulat,ed numerically. Finally, limited comparison of analytical and experimental results is presented for complete penetration of the target by the impactor.
Author
Impact Tests; Launchers; Titanium; Engine Failure

20040086852 NASA Langley Research Center, Hampton, VA, USA
X-33 Experimental Aeroheating at Mach 6 Using Phosphor Thermography
Horvath, Thomas J.; Berry, Scott A.; Hollis, Brian R.; Liechty, Derek S.; Hamilton, H. Harris, II; Merski, N. Ronald; [1999]; 18 pp.; In English; 33rd Thermophysics Conference, 28 Jun. - 1 Jul. 1999, Norfolk, VA, USA
Report No.(s): AIAA Paper 99-3558; Copyright; Avail: CASI; A03, Hardcopy

The goal of the NASA Reusable Launch Vehicle (RLV) technology program is to mature and demonstrate essential, cost effective technologies for next generation launch systems. The X-33 flight vehicle presently being developed by Lockheed Martin is an experimental Single Stage to Orbit (SSTO) demonstrator that seeks to validate critical technologies and insure applicability to a full scale RLV. As with the design of any hypersonic vehicle, the aeroheating environment is an important issue and one of the key technologies being demonstrated on X-33 is an advanced metallic Thermal Protection System (TPS). As part of the development of this TPS system, the X-33 aeroheating environment is being defined through conceptual analysis, ground based testing, and computational fluid dynamics. This report provides an overview of the hypersonic aeroheating wind tunnel program conducted at the NASA Langley Research Center in support of the ground based testing activities. Global surface heat transfer images, surface streamline patterns, and shock shapes were measured on 0.013 scale (10-in.) ceramic models of the proposed X-33 configuration in Mach 6 air. The test parametrics include angles of attack from -5 to 40 degs, unit Reynolds numbers from 1x106 to 8x106/ft, and body flap deflections of 0, 10, and 20 deg. Experimental and computational results indicate the presence of shock/shock interactions that produced localized heating on the deflected flaps and boundary layer transition on the canted fins. Comparisons of the experimental data to laminar and turbulent predictions were performed. Laminar windward heating data from the wind tunnel was extrapolated to flight surface temperatures and generally compared to within 50 deg F of flight prediction along the centerline. When coupled with the

phosphor technique, this rapid extrapolation method would serve as an invaluable TPS design tool.
Author
Aerodynamic Heating; Cost Effectiveness; Thermography; X-33 Reusable Launch Vehicle; Wind Tunnel Tests

20040086857 NASA Langley Research Center, Hampton, VA, USA
Transitioning Active Flow Control to Applications
Joslin, Ronald D.; Horta, Lucas G.; Chen, Fang-Jenq; [1999]; 13 pp.; In English; 30th AIAA Fluid Dynamics Conference, 28 Jun. - 1 Jul. 1999, Norfolk, VA, USA
Report No.(s): AIAA Paper 99-3575; Copyright; Avail: CASI; A03, Hardcopy

Active Flow Control Programs at NASA, the U.S. Air Force, and DARPA have been initiated with the goals of obtaining revolutionary advances in aerodynamic performance and maneuvering compared to conventional approaches. These programs envision the use of actuators, sensors, and controllers on applications such as aircraft wings/tails, engine nacelles, internal ducts, nozzles, projectiles, weapons bays, and hydrodynamic vehicles. Anticipated benefits of flow control include reduced weight, part count, and operating cost and reduced fuel burn (and emissions), noise and enhanced safety if the sensors serve a dual role of flow control and health monitoring. To get from the bench-top or laboratory test to adaptive distributed control systems on realistic applications, reliable validated design tools are needed in addition to sub- and large-scale wind-tunnel and flight experiments. This paper will focus on the development of tools for active flow control applications.
Author
Active Control; Aerodynamic Characteristics; Flow Distribution; Safety; Maneuvers

20040086859 NASA Langley Research Center, Hampton, VA, USA
Supersonic Coaxial Jet Experiment for CFD Code Validation
Cutler, A. D.; Carty, A. A.; Doerner, S. E.; Diskin, G. S.; Drummond, J. P.; [1999]; 14 pp.; In English; 30th AIAA Fluid Dynamics Conference, 28 Jun. - 1 Jul. 1999, Norfolk, VA, USA
Contract(s)/Grant(s): NCC1-217
Report No.(s): AIAA Paper 99-3588; Copyright; Avail: CASI; A03, Hardcopy

A supersonic coaxial jet facility has been designed to provide experimental data suitable for the validation of CFD codes used to analyze high-speed propulsion flows. The center jet is of a light gas and the coflow jet is of air, and the mixing layer between them is compressible. Various methods have been employed in characterizing the jet flow field, including schlieren visualization, pitot, total temperature and gas sampling probe surveying, and RELIEF velocimetry. A Navier-Stokes code has been used to calculate the nozzle flow field and the results compared to the experiment.
Author
Supersonic Jet Flow; Computational Fluid Dynamics; Velocity Measurement; Research Facilities; Design Analysis

20040086862 NASA Langley Research Center, Hampton, VA, USA
Computation of Turbulent Wake Flows in Variable Pressure Gradient
Duquesne, N.; Carlson, J. R.; Rumsey, C. L.; Gatski, T. B.; [1999]; 17 pp.; In English; 30th AIAA Fluid Dynamics Conference, 28 Jun. - 1 Jul. 1999, Norfolk, VA, USA
Report No.(s): AIAA Paper 99-3781; Copyright; Avail: CASI; A03, Hardcopy

Transport aircraft performance is strongly influenced by the effectiveness of high-lift systems. Developing wakes generated by the airfoil elements are subjected to strong pressure gradients and can thicken very rapidly, limiting maximum lift. This paper focuses on the effects of various pressure gradients on developing symmetric wakes and on the ability of a linear eddy viscosity model and a non-linear explicit algebraic stress model to accurately predict their downstream evolution. In order to reduce the uncertainties arising from numerical issues when assessing the performance of turbulence models, three different numerical codes with the same turbulence models are used. Results are compared to available experimental data to assess the accuracy of the computational results.
Author
Turbulent Wakes; Mathematical Models; Computation; Flow Velocity; Pressure Gradients

20040086896 Engineous Software, Inc., Atlanta, GA, USA
Form Follows Function and Physics: Simulation Based Optimization Drives the Shape of Tomorrow's Aerospace Products
VanderVelden, Alex; Innovative Design of Complex Engineering Systems; July 2004, pp. 125-155; In English; See also 20040086893; No Copyright; Avail: CASI; A03, Hardcopy

In this talk we will discuss the application of commercial process integration and design optimization tools in aircraft design from small bizjets to large commercial airliners. These tools allow us to generate aircraft designs directly based on economic and performance objectives as computed by high fidelity physics models. We will also take a look at the future, were integrated processes will be deployed across geographic and enterprise borders using the FIPER software.
Author
Aircraft Design; Design Optimization; Computerized Simulation

20040086900 Georgia Inst. of Tech., Atlanta, GA, USA
Physics Based Conceptual Design of Revolutionary Concepts: A 'Paradigm Shift' in Complex System Design
Mavris, Dimitri; Innovative Design of Complex Engineering Systems; July 2004, pp. 59-99; In English; See also 20040086893; No Copyright; Avail: CASI; A03, Hardcopy

The main motivation behind a physics-based conceptual design approach is the focus on unconventional systems for which no canned design programs exist. Currently, NASA has identified several classes of unconventional systems that it wishes to examine over the next several years. Some of those configurations are highlighted here. Unfortunately, since these systems are extremely unconventional, reliance upon historical data is often inappropriate. As such, efforts are underway at Georgia Tech to more fully understand these systems and model them in a variable-fidelity physics-based design environment.By physics-based, we mean that aircraft drag polars will be more accurately calculated using a panel method or CFD code. The propulsion systems will be analyzed from a cycle standpoint for both design and off design operation. The performance of the aircraft over many flight regimes will likely involve an energy or exergy-based approach to tracking the various performance constraints imposed upon the vehicle by the mission requirements. Structural analysis will require some sort of higher-level modeling than traditional zeroth order design codes that focus only on historical mass estimation relationships.
Author
Systems Engineering; Complex Systems; Design Analysis; Aeronautical Engineering

20040086932 NASA Langley Research Center, Hampton, VA, USA
RF Loading Effects of Aircraft Seats in an Electromagnetic Reverberating Environment
Nguyen, Truong; [2000]; 7 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

Loading effects of aircraft seats in an electromagnetic reverberating environment are investigated. The effects are determined by comparing the reverberation chamber s insertion losses with and without the seats. The average per-seat absorption cross-sections are derived for coach and first class seats, and the results are compared for several seat configurations. An example is given for how the seat absorption cross-sections can be used to estimate the loading effects on the RF environment in an aircraft passenger cabin.
Author
Radio Frequencies; Reverberation Chambers; Seats; Loads (Forces); Aircraft Compartments; Electromagnetism

20040086945 NASA Langley Research Center, Hampton, VA, USA
Flight Control Laws for NASA's Hyper-X Research Vehicle
Davidson, J.; Lallman, F.; McMinn, J. D.; Martin, J.; Pahle, J.; Stephenson, M.; Selmon, J.; Bose, D.; [1999]; 11 pp.; In English
Report No.(s): AIAA Paper 99-4124; Copyright; Avail: CASI; A03, Hardcopy

The goal of the Hyper-X program is to demonstrate and validate technology for design and performance predictions of hypersonic aircraft with an airframe-integrated supersonic-combustion ramjet propulsion system. Accomplishing this goal requires flight demonstration of a hydrogen-fueled scramjet powered hypersonic aircraft. A key enabling technology for this flight demonstration is flight controls. Closed-loop flight control is required to enable a successful stage separation, to achieve and maintain the design condition during the engine test, and to provide a controlled descent. Before the contract award, NASA developed preliminary flight control laws for the Hyper-X to evaluate the feasibility of the proposed scramjet test sequence and descent trajectory. After the contract award, a Boeing/NASA partnership worked to develop the current control laws. This paper presents a description of the Hyper-X Research Vehicle control law architectures with performance and robustness analyses. Assessments of simulated flight trajectories and stability margin analyses demonstrate that these control laws meet the flight test requirements.
Author
Flight Control; Flight Tests; Research Vehicles; Hypersonic Aircraft; Performance Prediction

20040086951 NASA Langley Research Center, Hampton, VA, USA

Modified Dynamic Inversion to Control Large Flexible Aircraft: What's Going On?

Gregory, Irene M.; [1999]; 12 pp.; In English; AIAA Guidance, Navigation and Control Conference, 9-11 Aug. 1999, Portland, OR, USA

Report No.(s): AIAA Paper 99-3998; Copyright; Avail: CASI; A03, Hardcopy

High performance aircraft of the future will be designed lighter, more maneuverable, and operate over an ever expanding flight envelope. One of the largest differences from the flight control perspective between current and future advanced aircraft is elasticity. Over the last decade, dynamic inversion methodology has gained considerable popularity in application to highly maneuverable fighter aircraft, which were treated as rigid vehicles. This paper explores dynamic inversion application to an advanced highly flexible aircraft. An initial application has been made to a large flexible supersonic aircraft. In the course of controller design for this advanced vehicle, modifications were made to the standard dynamic inversion methodology. The results of this application were deemed rather promising. An analytical study has been undertaken to better understand the nature of the made modifications and to determine its general applicability. This paper presents the results of this initial analytical look at the modifications to dynamic inversion to control large flexible aircraft.

Author

Dynamic Control; Elastic Properties; Flight Control; Highly Maneuverable Aircraft; Inversions

20040086964 NASA Langley Research Center, Hampton, VA, USA

Propulsion System Airframe Integration Issues and Aerodynamic Database Development for the Hyper-X Flight Research Vehicle

Engelund, Walter C.; Holland, Scott D.; Cockrell, Charles E., Jr.; Bittner, Robert D.; [1999]; 12 pp.; In English; XIV ISOABE, 5-10 Sep. 1999, Florence, Italy

Report No.(s): ISOABE-99-7215; Copyright; Avail: CASI; A03, Hardcopy

NASA's Hyper-X Research Vehicle will provide a unique opportunity to obtain data on an operational airframe integrated scramjet propulsion system at true flight conditions. The airframe integrated nature of the scramjet engine with the Hyper-X vehicle results in a strong coupling effect between the propulsion system operation and the airframe s basic aerodynamic characteristics. Comments on general airframe integrated scramjet propulsion system effects on vehicle aerodynamic performance, stability, and control are provided, followed by examples specific to the Hyper-X research vehicle. An overview is provided of the current activities associated with the development of the Hyper-X aerodynamic database, including wind tunnel test activities and parallel CFD analysis efforts. A brief summary of the Hyper-X aerodynamic characteristics is provided, including the direct and indirect effects of the airframe integrated scramjet propulsion system operation on the basic airframe stability and control characteristics.

Author

Airframes; Propulsion System Configurations; Research Vehicles; Hypersonic Vehicles; Systems Integration; Computational Fluid Dynamics; Wind Tunnel Tests

20040086987 NASA Langley Research Center, Hampton, VA, USA

The Mach 10 Component of NASA's Hyper-X Ground Test Program

Bakos, R. J.; Tsai, C.-Y.; Rogers, R. C.; Shih, A. T.; [1999]; 10 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

The Mach 10 Hyper-X ground test program is described, in which experimental flowpath parametric testing is being done in the HYPULSE facility. This facility has been upgraded for this effort by adding a reflected-shock-tunnel operating mode to access test conditions at Mach 10 and below. A large test section and hypersonic nozzle have been installed to provide full-scale engine test capability and the instrumentation systems have been expanded. A model of the Hyper-X engine flowpath has been built for freejet testing in the shock tunnel at both Mach 7 and 10 flight conditions. The model has over 180 instrumentation ports, a pitot rake mountable at the engine inlet or exit, and optical windows for visualization of the isolator, combustor, and nozzle. Testing in HYPULSE has been completed at Mach 7 conditions to provide a link between pulse facility data and the large Hyper-X performance database that is being accumulated in long-duration facilities. Comparisons of Mach 7 data with computational predictions and with data recently acquired for an identical flowpath being tested in the NASA 8-foot High Temperature Tunnel are presented.

Author

NASA Programs; Hypersonic Vehicles; Ground Tests; Full Scale Tests; Hypersonic Speed; Shock Tunnels; Mach Number

20040087007 NASA Langley Research Center, Hampton, VA, USA
Acoustic Characteristics of a Model Isolated Tiltrotor in DNW
Booth, Earl R., Jr.; McCluer, Megan; Tadghighi, Hormoz; [1999]; 10 pp.; In English; American Helicopter Society 55th Annual Forum, 25-27 May 1999, Montreal, Canada; Copyright; Avail: CASI; A02, Hardcopy

An aeroacoustic wind tunnel test was conducted using a scaled isolated tiltrotor model. Acoustic data were acquired using an in-flow microphone wing traversed beneath the model to map the directivity of the near-field acoustic radiation of the rotor for a parametric variation of rotor angle-of-attack, tunnel speed, and rotor thrust. Acoustic metric data were examined to show trends of impulsive noise for the parametric variations. BVISPL maximum noise levels were found to increase with alpha for constant mu and C(sub T), although the maximum BVI levels were found at much higher a than for a typical helicopter. BVISPL levels were found to increase with mu for constant alpha and C(sub T. BVISPL was found to decrease with increasing CT for constant a and m, although BVISPL increased with thrust for a constant wake geometry. Metric data were also scaled for M(sub up) to evaluate how well simple power law scaling could be used to correct metric data for M(sub up) effects.
Author
Wind Tunnel Tests; Acoustic Properties; Tilt Rotor Aircraft; Data Acquisition

20040087101 NASA Langley Research Center, Hampton, VA, USA
Control of Shock Loading from a Jet in the Presence of a Flexible Structure
Maestrello, Lucio; [1999]; 9 pp.; In English; 5th AIAA/CEAS Aeroacoustics Conference, 10-12 May 1999, Bellevue, WA, USA
Report No.(s): AIAA Paper 99-1975; Copyright; Avail: CASI; A02, Hardcopy

The control of shock noise or screech from a jet near a flexible structure is discussed. The pressure from the supersonic jet consists of a shock with spiral and flapping nonaxisymmetric modes superimposed on broadband response. This shock induces a nonlinear-nonstationary loading problem associated with acoustic wave generation and propagation coupled with structural vibration. Control of the shock is achieved by placing a ring at the nozzle lip oscillating at the shock fundamental frequency. The ring prevents the shock characteristics originating in the column of the shear layer from sustaining connection with the out-of-phase surface vibration. Shock-free flow is maintained over a large pressure ratio. The peak power pressure level is reduced by 40 dB.
Author
Aerodynamic Noise; Structural Vibration; Shock Loads; Jet Aircraft Noise; Active Control; Supersonic Jet Flow; Flexible Bodies

20040087154 NASA Langley Research Center, Hampton, VA, USA
Hyper-X Stage Separation: Background and Status
Reubush, David E.; [1999]; 12 pp.; In English; 9th International Space Planes and Hypersonic Systems and Technologies Conference, 1-5 Nov. 1999, Norfolk, VA, USA
Report No.(s): AIAA Paper 99-4818; Copyright; Avail: CASI; A03, Hardcopy

This paper provides an overview of stage separation activities for NASA's Hyper-X program; a focused hypersonic technology effort designed to move hypersonic, airbreathing vehicle technology from the laboratory environment to the flight environment. This paper presents an account of the development of the current stage separation concept, highlights of wind tunnel experiments and computational fluid dynamics investigations being conducted to define the separation event, results from ground tests of separation hardware, schedule and status. Substantial work has been completed toward reducing the risk associated with stage separation.
Author
Hypersonic Vehicles; Stage Separation; NASA Programs; Air Breathing Engines; Technology Utilization; Wind Tunnel Tests; Computational Fluid Dynamics

20040087160 NASA Langley Research Center, Hampton, VA, USA
CIAM/NASA Mach 6.5 Scramjet Flight and Ground Test
Voland, R. T.; Auslender, A. H.; Smart, M. K.; Roudakov, A. S.; Semenov, V. L.; Kopchenov, V.; [1999]; 9 pp.; In English
Report No.(s): AIAA Paper 99-4848; Copyright; Avail: CASI; A02, Hardcopy

The Russian Central Institute of Aviation Motors (CIAM) performed a flight test of a CIAM-designed, hydrogen-cooled/fueled dual-mode scramjet engine over a Mach number range of approximately 3.5 to 6.4 on February 12, 1998, at the Sary Shagan test range in Kazakhstan. This rocket-boosted, captive-carry test of the axisymmetric engine reached the highest Mach

number of any scramjet engine flight test to date. The flight test and the accompanying ground test program, conducted in a CIAM test facility near Moscow, were performed under a NASA contract administered by the Dryden Flight Research Center with technical assistance from the Langley Research Center. Analysis of the flight and ground data by both CIAM and NASA resulted in the following preliminary conclusions. An unexpected control sensor reading caused non-optimal fueling of the engine, and flowpath modifications added to the engine inlet during manufacture caused markedly reduced inlet performance. Both of these factors appear to have contributed to the dual-mode scramjet engine operating primarily in a subsonic combustion mode. At the maximum Mach number test point, combustion caused transition from supersonic flow at the fuel injector station to primarily subsonic flow in the combustor. Ground test data were obtained at similar conditions to the flight test, allowing for a meaningful comparison between the ground and flight data. The results of this comparison indicate that the differences in engine performance are small.
Author
Ground Tests; NASA Programs; Mach Number; Supersonic Combustion Ramjet Engines; Aeronautical Engineering; Hypersonic Speed; Russian Federation

20040087192 North Carolina State Univ., Raleigh, NC, USA
Enhancement of Buckling Load with the Use of Active Materials
Yuan, F. G.; December 1, 2002; 21 pp.; In English
Contract(s)/Grant(s): NAG1-01128; F49620-99-1-0110; No Copyright; Avail: CASI; A03, Hardcopy

In this paper, active buckling control of a beam using piezoelectric materials is investigated. Under small deformation, mathematical models are developed to describe the behavior of the beams subjected to an axial compressive load with geometric imperfections and load eccentricities under piezoelectric force. Two types of supports, simply supported and clamped, of the beam with a partially bonded piezoelectric actuator are used to illustrate the concept. For the beam with load eccentricities and initial geometric imperfections, the load- carrying capacity can be significantly enhanced by counteracting moments from the piezoelectric actuator. For the single piezoelectric actuator, using static feedback closed-loop control, the first buckling load can be eliminated. In the case of initially straight beams, analytical solutions of the enhanced first critical buckling load due to the increase of bending stiffness by piezoelectric actuators are derived based on linearized buckling analysis.
Author
Active Control; Buckling; Piezoelectric Actuators; Loads (Forces)

20040087266 NASA Langley Research Center, Hampton, VA, USA
Open Architecture Data System for NASA Langley Combined Loads Test System
Lightfoot, Michael C.; Ambur, Damodar R.; [1998]; 9 pp.; In English; 36th AIAA Aerospace Sciences Meeting and Exhibit, 12-15 Jan. 1998, Reno, NV, USA
Report No.(s): AIAA Paper 98-0345; Copyright; Avail: CASI; A02, Hardcopy

The Combined Loads Test System (COLTS) is a new structures test complex that is being developed at NASA Langley Research Center (LaRC) to test large curved panels and cylindrical shell structures. These structural components are representative of aircraft fuselage sections of subsonic and supersonic transport aircraft and cryogenic tank structures of reusable launch vehicles. Test structures are subjected to combined loading conditions that simulate realistic flight load conditions. The facility consists of two pressure-box test machines and one combined loads test machine. Each test machine possesses a unique set of requirements or research data acquisition and real-time data display. Given the complex nature of the mechanical and thermal loads to be applied to the various research test articles, each data system has been designed with connectivity attributes that support both data acquisition and data management functions. This paper addresses the research driven data acquisition requirements for each test machine and demonstrates how an open architecture data system design not only meets those needs but provides robust data sharing between data systems including the various control systems which apply spectra of mechanical and thermal loading profiles.
Author
Aircraft Structures; Curved Panels; Cylindrical Shells; Test Facilities; Structural Design; Supersonic Transports; Loads (Forces)

20040087268 NASA Langley Research Center, Hampton, VA, USA

Experimental Verification Of The Osculating Cones Method For Two Waverider Forebodies At Mach 4 and 6

Miller, Rolf W.; Argrow, Brian M.; Center, Kenneth B.; Brauckmann, Gregory J.; Rhode, Matthew N.; [1998]; 15 pp.; In English; 36th Aerospace Sciences Meeting and Exhibit, 12-15 Jan. 1998, Reno, NV, USA

Contract(s)/Grant(s): NGT1-52134

Report No.(s): AIAA Paper 98-0682; Copyright; Avail: CASI; A03, Hardcopy

The NASA Langley Research Center Unitary Plan Wind Tunnel and the 20-Inch Mach 6 Tunnel were used to test two osculating cones waverider models. The Mach-4 and Mach-6 shapes were generated using the interactive design tool WIPAR. WIPAR performance predictions are compared to the experimental results. Vapor screen results for the Mach-4 model at the on- design Mach number provide visual verification that the shock is attached along the entire leading edge, within the limits of observation. WIPAR predictions of pressure distributions and aerodynamic coefficients show general agreement with the corresponding experimental values.

Author

Forebodies; Supersonic Speed; Waveriders; Wind Tunnel Models; Mach Number; Double Cusps

20040087325 Federal Aviation Administration, Washington, DC

MIL-W-22759 Vertical Flammability Test Versus the 60 Deg Flammability Test

Gomez, C.; Jun. 2004; 50 pp.; In English

Report No.(s): PB2004-106638; DOT/FAA/AR-TN04/21; No Copyright; Avail: CASI; A03, Hardcopy

There is a need to clarify the wire flammability compliance requirements specified in the latest amendments of Title 14 Code of Federal Regulations and the Airworthiness Manual (CFR/AWM) for the detailed specification sheet MIL-W-22759/16. CFR requirements prescribe a 60 degree flammability test for the MIL-W-22759 specification sheet, while MIL-W-22759/16 calls for a vertical flammability test. Confusion lies as to which of the requirements should be followed. This technical note will show how the MIL-W-22759/16 specification sheet satisfies both flammability requirements.

NTIS

Aircraft Equipment; Wire; Aircraft Reliability

20040087341 NASA Langley Research Center, Hampton, VA, USA

Spatial Characteristics of F/A-18 Vertical Tail Buffet Pressures Measured in Flight

Moses, Robert W.; Shah, Gautam H.; [1998]; 10 pp.; In English

Report No.(s): AIAA Paper 98-1956; Copyright; Avail: CASI; A02, Hardcopy

Buffeting is an aeroelastic phenomenon which plagues high performance aircraft, especially those with twin vertical tails, at high angles of attack. Previous wind-tunnel and flight tests were conducted to characterize the buffet loads on the vertical tails by measuring surface pressures, bending moments, and accelerations. Following these tests, buffeting estimates were computed using the measured buffet pressures and compared to the measured responses. The estimates did not match the measured data because the assumed spatial correlation of the buffet pressures was not correct. A better understanding of the partial (spatial) correlation of the differential buffet pressures on the tail was necessary to improve the buffeting estimates. Several wind-tunnel investigations were conducted for this purpose. When combined and compared, the results of these tests show that the partial correlation depends on and scales with flight conditions. One of the remaining questions is whether the windtunnel data is consistent with flight data. Presented herein, cross-spectra and coherence functions calculated from pressures that were measured on the high alpha research vehicle (HARV) indicate that the partial correlation of the buffet pressures in flight agrees with the partial correlation observed in the wind tunnel.

Author

Aeroelasticity; Buffeting; Flight Tests; Pressure Measurement; Wind Tunnel Tests; F-18 Aircraft; Spatial Dependencies; Tail Assemblies

20040087357 NASA Langley Research Center, Hampton, VA, USA

Nonaxisymmetric Disturbances in a Jet and Their Effect on Structural Loading

Bayliss, A.; Maestrello, L.; [January 2004]; 12 pp.; In English; 4th AIAA/CEAS Aeroacoustics Conference, 2-4 Jun. 1998, Toulouse, France

Contract(s)/Grant(s): NAS1-19480; DMS 93-01635; DMS 95-30937

Report No.(s): AIAA Paper 98-2277; Copyright; Avail: CASI; A03, Hardcopy

A model of sound generated in a high subsonic (Mach 0.9) circular jet is solved numerically in cylindrical coordinates

for nonaxisymmetric disturbances. The jet is excited by transient mass injection by a finite duration pulse via a rotating ring source. The flow field, near field and far field pressure disturbances corresponding to these sources are described. In particular, the resulting pressure field, which would serve to excite nearby panels, is illustrated together with preliminary results on the excitation of thin slices of nearby panels. We consider both the short time behavior of the jet and the long time behavior, after the initial excitation pulse has exited the computational domain. The long time behavior of the jet is dominated by vorticity and pressure disturbances generated at the nozzle lip and growing as they convect downstream in the jet. These disturbances generate sound as they propagate. We find that rotating nonaxisymmetric disturbances persist for long times. Furthermore, depending on location, both in phase and out of phase behavior can be found upon reflection across the jet axis.
Author
Loads (Forces); Aeroacoustics; Mathematical Models; Unsteady Aerodynamics; Noise Prediction (Aircraft); Jet Flow; Axisymmetric Bodies; Aircraft Structures

20040088578 NASA Langley Research Center, Hampton, VA, USA
Hyper-X Engine Design and Ground Test Program
Voland, R. T.; Rock, K. E.; Huebner, L. D.; Witte, D. W.; Fischer, K. E.; McClinton, C. R.; [1998]; 13 pp.; In English; AIAA 8th International Space Planes and Hypersonic Systems and Technologies Conference, 27-30 Apr. 1998, Norfolk, VA, USA
Report No.(s): AIAA Paper 98-1532; Copyright; Avail: CASI; A03, Hardcopy

The Hyper-X Program, NASA's focused hypersonic technology program jointly run by NASA Langley and Dryden, is designed to move hypersonic, air-breathing vehicle technology from the laboratory environment to the flight environment, the last stage preceding prototype development. The Hyper-X research vehicle will provide the first ever opportunity to obtain data on an airframe integrated supersonic combustion ramjet propulsion system in flight, providing the first flight validation of wind tunnel, numerical and analytical methods used for design of these vehicles. A substantial portion of the integrated vehicle/engine flowpath development, engine systems verification and validation and flight test risk reduction efforts are experimentally based, including vehicle aeropropulsive force and moment database generation for flight control law development, and integrated vehicle/engine performance validation. The Mach 7 engine flowpath development tests have been completed, and effort is now shifting to engine controls, systems and performance verification and validation tests, as well as, additional flight test risk reduction tests. The engine wind tunnel tests required for these efforts range from tests of partial width engines in both small and large scramjet test facilities, to tests of the full flight engine on a vehicle simulator and tests of a complete flight vehicle in the Langley 8-Ft. High Temperature Tunnel. These tests will begin in the summer of 1998 and continue through 1999. The first flight test is planned for early 2000.
Author
Air Breathing Engines; Performance Tests; Hypersonic Vehicles; Flight Tests; Engine Design; Test Facilities

20040088815 NASA Langley Research Center, Hampton, VA, USA
Design-Oriented Analysis of Aircraft Fuselage Structures
Giles, Gary L.; [1998]; 14 pp.; In English
Report No.(s): AIAA Paper 98-1749; Copyright; Avail: CASI; A03, Hardcopy

A design-oriented analysis capability for aircraft fuselage structures that utilizes equivalent plate methodology is described. This new capability is implemented as an addition to the existing wing analysis procedure in the Equivalent Laminated Plate Solution (ELAPS) computer code. The wing and fuselage analyses are combined to model entire airframes. The paper focuses on the fuselage model definition, the associated analytical formulation and the approach used to couple the wing and fuselage analyses. The modeling approach used to minimize the amount of preparation of input data by the user and to facilitate the making of design changes is described. The fuselage analysis is based on ring and shell equations but the procedure is formulated to be analogous to that used for plates in order to take advantage of the existing code in ELAPS. Connector springs are used to couple the wing and fuselage models. Typical fuselage analysis results are presented for two analytical models. Results for a ring-stiffened cylinder model are compared with results from conventional finite-element analyses to assess the accuracy of this new analysis capability. The connection of plate and ring segments is demonstrated using a second model that is representative of the wing structure for a channel-wing aircraft configuration.
Author
Fuselages; Aircraft Design; Structural Analysis; Body-Wing Configurations; Mathematical Models; Shells (Structural Forms)

20040089860 NASA Langley Research Center, Hampton, VA, USA
Neural Networks for Rapid Design and Analysis
Sparks, Dean W., Jr.; Maghami, Peiman G.; [1998]; 9 pp.; In English
Report No.(s): AIAA Paper 98-1779; Copyright; Avail: CASI; A02, Hardcopy

Artificial neural networks have been employed for rapid and efficient dynamics and control analysis of flexible systems. Specifically, feedforward neural networks are designed to approximate nonlinear dynamic components over prescribed input ranges, and are used in simulations as a means to speed up the overall time response analysis process. To capture the recursive nature of dynamic components with artificial neural networks, recurrent networks, which use state feedback with the appropriate number of time delays, as inputs to the networks, are employed. Once properly trained, neural networks can give very good approximations to nonlinear dynamic components, and by their judicious use in simulations, allow the analyst the potential to speed up the analysis process considerably. To illustrate this potential speed up, an existing simulation model of a spacecraft reaction wheel system is executed, first conventionally, and then with an artificial neural network in place.
Author
Neural Nets; Dynamic Control; Design Analysis; Reaction Wheels; Simulation

20040090462 NASA Langley Research Center, Hampton, VA, USA
A Study of Supersonic Surface Sources: The Ffowcs Williams-Hawkings Equation and the Kirchhoff Formula
Farassat, F.; Brentner, Kenneth S.; Dunn, M. H.; [2004]; 14 pp.; In English; 4th AIAA/CEAS Aeroacoustics Conference, 2-4 Jun. 1998, Toulouse, France
Report No.(s): AIAA Paper 98-2375; Copyright; Avail: CASI; A03, Hardcopy

In this paper we address the mathematical problem of noise generation from high speed moving surfaces. The problem we are solving is the linear wave equation with sources on a moving surface. The Ffowcs Williams-Hawkings (FW-H) equation as well as the govern- ing equation for deriving the Kirchhoff formula for moving surfaces are both this type of partial differential equation. We give a new exact solution of this problem here in closed form which is valid for subsonic and supersonic motion of the surface but it is particularly suitable for supersonically moving surfaces. This new solution is the simplest of all high speed formulations of Langley and is denoted formulation 4 following the tradition of numbering of our major results for the prediction of the noise of rotating blades. We show that for a smooth surface moving at supersonic speed, our solution has only removable singularities. Thus it can be used for numerical work.
Author
Supersonic Speed; Aeroacoustics; Kirchhoff Law; Surface Properties; Mathematical Models; Rotor Blades (Turbomachinery); Rotating Bodies

20040090465 NASA Langley Research Center, Hampton, VA, USA
Efficient Viscous Design of Realistic Aircraft Configurations
Campbell, Richard L.; [2004]; 17 pp.; In English
Report No.(s): AIAA Paper 98-2539; Copyright; Avail: CASI; A03, Hardcopy

This paper addresses the use of the Constrained Direct Iterative Surface Curvature (CDISC) design method in the aircraft design process. A discussion of some of the requirements for practical use of CFD in the design process is followed by a description of different CFD design methods, along with their relative strengths and weaknesses. A detailed description of the CDISC design method highlights some of the aspects of the method that provide computational efficiency and portability, as well as the flow and geometry constraint capabilities. In addition, an efficient approach to multipoint design, the Weighted Averaging of Geometries (WAG) method, is described and illustrated using a couple of simple examples. The CDISC and WAG methods are then applied to a complex generic business jet geometry using an unstructured grid flow solver to demonstrate the multipoint and multicomponent design capabilities of these methods. Introduction
Author
Viscosity; Flow Geometry; Computational Fluid Dynamics; Aircraft Design

20040090482 NASA Langley Research Center, Hampton, VA, USA
Fundamental Investigations of Airframe Noise
Macaraeg, M. G.; [2004]; 10 pp.; In English
Report No.(s): AIAA Paper 98-2224; Copyright; Avail: CASI; A02, Hardcopy

An extensive numerical and experimental study of airframe noise mechanisms associated with a subsonic high-lift system has been performed at NASA Langley Research Center (LaRC). Investigations involving both steady and unsteady computations and experiments on a small-scale, part-span flap model are presented. Both surface (steady and unsteady pressure measurements, hot films, oil flows, pressure sensitive paint) and off surface (5 hole-probe, particle-imaged velocimetry, laser velocimetry, laser light sheet measurements) were taken in the LaRC Quiet Flow Facility (QFF) and several hard-wall tunnels up to flight Reynolds number. Successful microphone array measurements were also taken providing both

acoustic source maps on the model, and quantitative spectra. Critical directivity measurements were obtained in the QFF. NASA Langley unstructured and structured Reynolds- Averaged Navier-Stokes codes modeled the flap geometries excellent comparisons with surface and offsurface experimental data were obtained. Subsequently, these meanflow calculations were utilized in both linear stability and direct numerical simulations of the flap-edge flow field to calculate unsteady surface pressures and farfield acoustic spectra. Accurate calculations were critical in obtaining not only noise source characteristics, but shear layer correction data as well. Techniques utilized in these investigations as well as brief overviews of results will be given.
Author
Aircraft Noise; Airframes; Subsonic Aircraft; Aeroacoustics; Wind Tunnel Tests; Aerodynamic Noise

20040090483 NASA Langley Research Center, Hampton, VA, USA
Numerical Simulation of a Flap-Edge Flowfield
Streett, C. L.; [1998]; 12 pp.; In English
Report No.(s): AIAA Paper 98-226; Copyright; Avail: CASI; A03, Hardcopy

In this paper we develop an approximate computational framework for simulation of the fluctuating flowfield associated with the complex vortex system seen at the side edge of a flap in a multielement high-lift airfoil system. The eventual goal of these simulations is to provide an estimate of the spectral content of these fluctuations, in order that the spectrum of the noise generated by such flowfields may be estimated. Results from simulations utilizing this computational framework are shown.
Author
Flow Distribution; Leading Edge Flaps; Aircraft Noise; Aeroacoustics; Flapping; Simulation; Numerical Analysis

20040090484 NASA Langley Research Center, Hampton, VA, USA
Fuselage Structure Response to Boundary Layer, Tonal Sound, and Jet Noise
Maestrello, L.; [2004]; 12 pp.; In English
Report No.(s): AIAA Paper 98-2276; Copyright; Avail: CASI; A03, Hardcopy

Experiments have been conducted to study the response of curved aluminum and graphite-epoxy fuselage structures to flow and sound loads from turbulent boundary layer, tonal sound, and jet noise. Both structures were the same size. The aluminum structure was reinforced with tear stoppers, while the graphite-epoxy structure was not. The graphite-epoxy structure weighed half as much as the aluminum structure. Spatiotemporal intermittence and chaotic behavior of the structural response was observed, as jet noise and tonal sound interacted with the turbulent boundary layer. The fundamental tone distributed energy to other components via wave interaction with the turbulent boundary layer. The added broadband sound from the jet, with or without a shock, influenced the responses over a wider range of frequencies. Instantaneous spatial correlation indicates small localized spatiotemporal regions of convected waves, while uncorrelated patterns dominate the larger portion of the space. By modifying the geometry of the tear stoppers between panels and frame, the transmitted and reflected waves of the aluminum panels were significantly reduced. The response level of the graphite-epoxy structure was higher, but the noise transmitted was nearly equal to that of the aluminum structure. The fundamental shock mode is between 80 deg and 150 deg and the first harmonic is between 20 deg and 80 deg for the underexpanded supersonic jet impinging on the turbulent boundary layer influencing the structural response. The response of the graphite-epoxy structure due to the fundamental mode of the shock impingement was stabilized by an externally fixed oscillator.
Author
Fuselages; Aluminum; Graphite-Epoxy Composites; Curved Panels; Turbulent Boundary Layer; Aircraft Noise; Aeroacoustics

20040090486 NASA Langley Research Center, Hampton, VA, USA
Aerothermodynamic Flight Simulation Capabilities for Aerospace Vehicles
Miller, Charles G.; [1998]; 3 pp.; In English; 20th AIAA Advanced Measurements and Ground Testing Technology Conference, 15-18 Jun. 1998, Albuquerque, NM, USA
Report No.(s): AIAA Paper 98-2600; Copyright; Avail: CASI; A01, Hardcopy

Aerothermodynamics, encompassing aerodynamics, aeroheating, and fluid dynamics and physical processes, is the genesis for the design and development of advanced space transportation vehicles and provides crucial information to other disciplines such as structures, materials, propulsion, avionics, and guidance, navigation and control. Sources of aerothermodynamic information are ground-based facilities, Computational Fluid Dynamic (CFD) and engineering computer

codes, and flight experiments. Utilization of this aerothermodynamic triad provides the optimum aerothermodynamic design to safely satisfy mission requirements while reducing design conservatism, risk and cost. The iterative aerothermodynamic process for initial screening/assessment of aerospace vehicle concepts, optimization of aerolines to achieve/exceed mission requirements, and benchmark studies for final design and establishment of the flight data book are reviewed. Aerothermodynamic methodology centered on synergism between ground-based testing and CFD predictions is discussed for various flow regimes encountered by a vehicle entering the Earth s atmosphere from low Earth orbit. An overview of the resources/infrastructure required to provide accurate/creditable aerothermodynamic information in a timely manner is presented. Impacts on Langley s aerothermodynamic capabilities due to recent programmatic changes such as Center reorganization, downsizing, outsourcing, industry (as opposed to NASA) led programs, and so forth are discussed. Sample applications of these capabilities to high Agency priority, fast-paced programs such as Reusable Launch Vehicle (RLV)/X-33 Phases I and 11, X-34, Hyper-X and X-38 are presented and lessons learned discussed. Lastly, enhancements in ground-based testing/CFD capabilities necessary to partially/fully satisfy future requirements are addressed.
Author
Aerodynamics; Flight Simulation; Aerodynamic Heating; Fluid Dynamics; Design to Cost; Computational Fluid Dynamics

20040090494 NASA Langley Research Center, Hampton, VA, USA
Thickness Noise of Helicopter Rotors at High Tip Speeds
Farassat, F.; Pegg, R. J.; Hilton, D. A.; [1975]; 7 pp.; In English; AIAA 2nd Aero-Acoustics Conference, 24-26 Mar. 1975, Hampton, VA, USA
Contract(s)/Grant(s): NGR-09-010-085
Report No.(s): AIAA Paper 75-453; Copyright; Avail: CASI; A02, Hardcopy

A new formulation of helicopter rotor thickness, noise for hover and forward flight, is discussed. The parameters required for this formulation are rotor motion, planform and airfoil thickness distribution. A computer program has been developed to calculate the pressure signature due to blade thickness for a helicopter in arbitrary motion. Comparison with high-speed helicopter tests shows good agreement with calculations when the observer is in or near the horizontal plane in which the rotor disc lies. Characteristics of thickness noise are illustrated by numerical examples indicating strongly that the high-speed blade slap may be due primarily to the thickness effect. The methods of Deming and Arnoldi are discussed as the special cases of this technique.
Author
Aircraft Noise; Helicopters; Tip Speed; Rotor Aerodynamics; Rotary Wings; Airfoil Profiles; High Speed

20040090503 NASA Langley Research Center, Hampton, VA, USA
Impact of Fuselage Cross Section on the Stability of a Generic Fighter
Hall, Robert M.; [1998]; 11 pp.; In English
Report No.(s): AIAA Paper 98-2725; Copyright; Avail: CASI; A03, Hardcopy

Many traditional data bases, which involved smooth-sided forebodies, are no longer relevant for designing advanced aircraft. The current work provides data on the impact of chined-shaped fuselage cross section on the stability of a generic fighter configuration. Two different chined-shaped fuselages were tested upright and inverted. It was found that a fuselage with a 30’ included chine angle resulted in significantly higher values of fuselage with a 100’ included chine angle. This difference was attributed to the more beneficial vortical interaction between the stronger forebody vortices coming off of the sharper chine edges and the wing vortices. The longitudinal stability of the configuration with the sharper chine angle was also better because, based on pressures and flow visualization, the vortex burst over the wing was delayed until significantly higher values of a. Unstable rolling moment derivatives were also delayed to higher values of a for the sharper chine angle cross section. Furthermore, it was found that directional stability of both of the upright configurations, which had larger lofts in cross section above the chine lines than below the chine lines. was better than for the inverted configurations.
Author
Vortices; Stability; Rolling Moments; Longitudinal Stability; Fuselages

20040090509 Army Research Lab., Hampton, VA, USA
Important Scaling Parameters for Testing Model-Scale Helicopter Rotors
Singleton, Jeffrey D.; Yeager, William T., Jr.; [1998]; 11 pp.; In English
Report No.(s): AIAA Paper 98-2881; Copyright; Avail: CASI; A03, Hardcopy

An investigation into the effects of aerodynamic and aeroelastic scaling parameters on model scale helicopter rotors has

been conducted in the NASA Langley Transonic Dynamics Tunnel. The effect of varying Reynolds number, blade Lock number, and structural elasticity on rotor performance has been studied and the performance results are discussed herein for two different rotor blade sets at two rotor advance ratios. One set of rotor blades were rigid and the other set of blades were dynamically scaled to be representative of a main rotor design for a utility class helicopter. The investigation was con-densities permits the acquisition of data for several Reynolds and Lock number combinations.
Author
Data Acquisition; Elastic Properties; Helicopters; Models; Rotors

20040090515 NASA Langley Research Center, Hampton, VA, USA
Static Performance of a Wing-Mounted Thrust Reverser Concept
Asbury, Scott C.; Yetter, Jeffrey A.; [1998]; 20 pp.; In English; 34th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 13-15 Jul. 1998, Cleveland, OH, USA
Report No.(s): AIAA Paper 98-3256; Copyright; Avail: CASI

An experimental investigation was conducted in the Jet-Exit Test Facility at NASA Langley Research Center to study the static aerodynamic performance of a wing-mounted thrust reverser concept applicable to subsonic transport aircraft. This innovative engine powered thrust reverser system is designed to utilize wing-mounted flow deflectors to produce aircraft deceleration forces. Testing was conducted using a 7.9%-scale exhaust system model with a fan-to-core bypass ratio of approximately 9.0, a supercritical left-hand wing section attached via a pylon, and wing-mounted flow deflectors attached to the wing section. Geometric variations of key design parameters investigated for the wing-mounted thrust reverser concept included flow deflector angle and chord length, deflector edge fences, and the yaw mount angle of the deflector system (normal to the engine centerline or parallel to the wing trailing edge). All tests were conducted with no external flow and high pressure air was used to simulate core and fan engine exhaust flows. Test results indicate that the wing-mounted thrust reverser concept can achieve overall thrust reverser effectiveness levels competitive with (parallel mount), or better than (normal mount) a conventional cascade thrust reverser system. By removing the thrust reverser system from the nacelle, the wing-mounted concept offers the nacelle designer more options for improving nacelle aero dynamics and propulsion-airframe integration, simplifying nacelle structural designs, reducing nacelle weight, and improving engine maintenance access.
Author
Subsonic Speed; Supercritical Wings; Test Facilities; Thrust Reversal; Transport Aircraft; Statics; Supports; Structural Design

20040090518 NASA Langley Research Center, Hampton, VA, USA
In-Flight System Identification
Morelli, Eugene A.; [1998]; 10 pp.; In English
Report No.(s): AIAA Paper 98-4261; Copyright; Avail: CASI

A method is proposed and studied whereby the system identification cycle consisting of experiment design and data analysis can be repeatedly implemented aboard a test aircraft in real time. This adaptive in-flight system identification scheme has many advantages, including increased flight test efficiency, adaptability to dynamic characteristics that are imperfectly known a priori, in-flight improvement of data quality through iterative input design, and immediate feedback of the quality of flight test results. The technique uses equation error in the frequency domain with a recursive Fourier transform for the real time data analysis, and simple design methods employing square wave input forms to design the test inputs in flight. Simulation examples are used to demonstrate that the technique produces increasingly accurate model parameter estimates resulting from sequentially designed and implemented flight test maneuvers. The method has reasonable computational requirements, and could be implemented aboard an aircraft in real time.
Author
Design Analysis; Experiment Design; System Identification; In-Flight Simulation; Mathematical Models

20040090522 NASA Langley Research Center, Hampton, VA, USA
Preliminary Study of Relationships between Stability and Control Characteristics and Affordability for High-Performance Aircraft
Ogburn, Marilyn E.; [1998]; 14 pp.; In English
Report No.(s): AIAA Paper 98-4265; Copyright; Avail: CASI; A03, Hardcopy

This paper describes a study that is being done as part of the Methods for Affordable Design (MAD) program within the National Aeronautics and Space Administration (NASA), for which the goal is to develop design methods and information that

contribute to reductions in the aircraft development cycle time while increasing design confidence throughout the design cycle. The product of the study will be a database of information that relates key stability and control parameters to affordability considerations such as air combat exchange ratio, safety of flight, and probability of loss of the aircraft or pilot. The overall background and methodology are described, and preliminary results are shown for the first phase of the study to evaluate characteristics in the longitudinal axis. For these preliminary results a simplified analytical model of the aircraft response to uncommanded nose-up pitching moments was developed and used to characterize the requirements for recoveries to controlled flight conditions and to evaluate some parameters that affect the survivability of the aircraft and the pilot.
Author
Aircraft Design; Control Stability; Aircraft Performance; Aircraft Survivability; Aerodynamic Characteristics

20040090526 NASA Langley Research Center, Hampton, VA, USA
An Aerodynamic Assessment of Micro-Drag Generators (MDGs)
Bauer, Steven X. S.; [1998]; 12 pp.; In English; 16th AIAA Applied Aerodynamics Conference, 15-18 Jun. 1998, Albuquerque, NM, USA
Report No.(s): AIAA Paper 98-2621; Copyright; Avail: CASI; A03, Hardcopy

Commercial transports as well as fighter aircraft of the future are being designed with very low drag (friction and pressure). Concurrently, commuter airports are being built or envisioned to be built in the centers of metropolitan areas where shorter runways and/or reduced noise footprints on takeoff and landing are required. These requirements and the fact that drag is lower on new vehicles than on older aircraft have resulted in vehicles that require a large amount of braking force (from landing-gear brakes, spoilers, high-lift flaps, thrust reversers, etc.). Micro-drag generators (MDGs) were envisioned to create a uniformly distributed drag force along a vehicle by forcing the flow to separate on the aft-facing surface of a series of deployable devices, thus, generating drag. The devices are intended to work at any speed and for any type of vehicle (aircraft, ground vehicles, sea-faring vehicles). MDGs were applied to a general aviation wing and a representative fuselage shape and tested in two subsonic wind tunnels. The results showed increases in drag of 2 to 6 times that of a ‘clean’ configuration.
Author
Aerodynamic Drag; Generators; Drag; Friction; Low Pressure; Takeoff

20040090539 NASA Langley Research Center, Hampton, VA, USA
A Piloted Simulation Study of Wake Turbulence on Final Approach
Stewart, Eric C.; [1998]; 16 pp.; In English
Report No.(s): AIAA Paper 98-4339; Copyright; Avail: CASI; A03, Hardcopy

A piloted simulation study has been conducted in a research simulator to provide a means to estimate the effects of different levels of wake turbulence on final approach. A worst-case methodology was used to ensure conservative estimates. Fourteen airline pilots voluntarily participated in the study and flew almost 1000 approaches. The pilots rated the subjective severity of the disturbances using a special rating scale developed for this study. Several objective measures of the airplane/pilot response to the simulated wake turbulence were also made. All the data showed a large amount of variation between pilots and to a lesser extent for a given pilot. Therefore, the data were presented at 50, 70, 90 percentile levels as a function of vortex strength. The data allow estimates of the vortex strength for a given subjective or objective response and vice versa. The results of this study appear to be more conservative than the results of previous studies.
Author
Computerized Simulation; Turbulence; Aircraft Wakes; Aircraft Pilots; Aircraft Approach Spacing

20040090578 NASA Langley Research Center, Hampton, VA, USA
Recent Dynamic Measurements and Considerations for Aerodynamic Modeling of Fighter Airplane Configurations
Brandon, Jay M.; Foster, John V.; [1998]; 17 pp.; In English
Report No.(s): AIAA Paper 98-4447; Copyright; Avail: CASI; A03, Hardcopy

As airplane designs have trended toward the expansion of flight envelopes into the high angle of attack and high angular rate regimes, concerns regarding modeling the complex unsteady aerodynamics for simulation have arisen. Most current modeling methods still rely on traditional body axis damping coefficients that are measured using techniques which were intended for relatively benign flight conditions. This paper presents recent wind tunnel results obtained during large-amplitude pitch, roll and yaw testing of several fighter airplane configurations. A review of the similitude requirements for applying sub-scale test results to full-scale conditions is presented. Data is then shown to be a strong function of Strouhal number - both the traditional damping terms, but also the associated static stability terms. Additionally, large effects of sideslip are seen in

the damping parameter that should be included in simulation math models. Finally, an example of the inclusion of frequency effects on the data in a simulation is shown.
Author
Aircraft Configurations; Fighter Aircraft; Unsteady Aerodynamics; Wind Tunnel Tests; Mathematical Models; Dynamic Tests

20040090610 NASA Langley Research Center, Hampton, VA, USA
Progress Toward Using Sensitivity Derivatives in a High-Fidelity Aeroelastic Analysis of a Supersonic Transport
Sobieszczanski-Sobieski, Jaroslaw; [1998]; 13 pp.; In English
Report No.(s): AIAA Paper 98-4763; Copyright; Avail: CASI; A03, Hardcopy

Several government/commercial off-the-shelf modular software packages have been combined to perform
Author
Aeroelasticity; Applications Programs (Computers); Supersonic Transports

20040090629 NASA Langley Research Center, Hampton, VA, USA
A Discussion of Knowledge Based Design
Wood, Richard M.; Bauer, Steven X. S.; [1998]; 20 pp.; In English; 7th AIAA/USAF/NASA/ISSMO Symposium on Multidisciplinary Analysis and Optimization, 2-4 Sep. 1998, Saint Louis, MO, USA
Report No.(s): AIAA Paper 98-4944; Copyright; Avail: CASI; A03, Hardcopy

A discussion of knowledge and Knowledge- Based design as related to the design of aircraft is presented. The paper discusses the perceived problem with existing design studies and introduces the concepts of design and knowledge for a Knowledge- Based design system. A review of several Knowledge-Based design activities is provided. A Virtual Reality, Knowledge-Based system is proposed and reviewed. The feasibility of Virtual Reality to improve the efficiency and effectiveness of aerodynamic and multidisciplinary design, evaluation, and analysis of aircraft through the coupling of virtual reality technology and a Knowledge-Based design system is also reviewed. The final section of the paper discusses future directions for design and the role of Knowledge-Based design.
Author
Knowledge Based Systems; Design Analysis; Aircraft Design

20040095867 NASA Langley Research Center, Hampton, VA, USA
NASA Langley Research Center's Simulation-To-Flight Concept Accomplished through the Integration Laboratories of the Transport Research Facility
Martinez, Debbie; Davidson, Paul C.; Kenney, P. Sean; Hutchinson, Brian K.; [2004]; 14 pp.; In English; AIAA Modeling and Simulation Technologies Conference, 16-19 Aug. 2004, Providence, RI, USA
Report No.(s): AIAA Paper 2004-4934; No Copyright; Avail: CASI; A03, Hardcopy

The Flight Simulation and Software Branch (FSSB) at NASA Langley Research Center (LaRC) maintains the unique national asset identified as the Transport Research Facility (TRF). The TRF is a group of facilities and integration laboratories utilized to support the LaRC's simulation-to-flight concept. This concept incorporates common software, hardware, and processes for both groundbased flight simulators and LaRC s B-757-200 flying laboratory identified as the Airborne Research Integrated Experiments System (ARIES). These assets provide Government, industry, and academia with an efficient way to develop and test new technology concepts to enhance the capacity, safety, and operational needs of the ever-changing national airspace system. The integration of the TRF enables a smooth continuous flow of the research from simulation to actual flight test.
Author
Flight Simulation; Flight Tests; Systems Integration; Computerized Simulation

06
AVIONICS AND AIRCRAFT INSTRUMENTATION

Includes all avionics systems, cockpit and cabin display devices, and flight instruments intended for use in aircraft. For related information see also *04 Aircraft Communications and Navigation; 08 Aircraft Stability and Control; 19 Spacecraft Instrumentation and Astrionics*; and *35 Instrumentation and Photography*.

20040086674 NASA Langley Research Center, Hampton, VA, USA
Detecting Controller Malfunctions in Electromagnetic Environments, Part 1, Modeling and Estimation of Nominal System Function
Weinstein, Bernice; [1999]; 7 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

A strategy for detecting control law calculation errors in critical flight control computers during laboratory validation testing is presented. This paper addresses Part I of the detection strategy which involves the use of modeling of the aircraft control laws and the design of Kalman filters to predict the correct control commands. Part II of the strategy which involves the use of the predicted control commands to detect control command errors is presented in the companion paper.
Author
Airborne/Spaceborne Computers; Flight Control; Controllers; Malfunctions; Aircraft Control; Electromagnetic Interference

20040086745 Army Research Lab., Hampton, VA, USA
Non-Linear Finite Element Modeling of THUNDER Piezoelectric Actuators
Talegham, Barmac K.; Campbell, Joel F.; [2001]; 13 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

A NASTRAN non-linear finite element model has been developed for predicting the dome heights of THUNDER (THin Layer UNimorph Ferroelectric DrivER) piezoelectric actuators. To analytically validate the finite element model, a comparison was made with a non-linear plate solution using Von Karmen s approximation. A 500 volt input was used to examine the actuator deformation. The NASTRAN finite element model was also compared with experimental results. Four groups of specimens were fabricated and tested. Four different input voltages, which included 120, 160, 200, and 240 V(sub p-p) with a 0 volts offset, were used for this comparison.
Author
Nonlinearity; Finite Element Method; Piezoelectric Actuators; Fabrication

20040086769 NASA Langley Research Center, Hampton, VA, USA
Crew/Automation Interaction in Space Transportation Systems: Lessons Learned from the Glass Cockpit
Rudisill, Marianne; [2000]; 14 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

The progressive integration of automation technologies in commercial transport aircraft flight decks - the ‘glass cockpit’ - has had a major, and generally positive, impact on flight crew operations. Flight deck automation has provided significant benefits, such as economic efficiency, increased precision and safety, and enhanced functionality within the crew interface. These enhancements, however, may have been accrued at a price, such as complexity added to crew/automation interaction that has been implicated in a number of aircraft incidents and accidents. This report briefly describes ‘glass cockpit’ evolution. Some relevant aircraft accidents and incidents are described, followed by a more detailed description of human/automation issues and problems (e.g., crew error, monitoring, modes, command authority, crew coordination, workload, and training). This paper concludes with example principles and guidelines for considering ‘glass cockpit’ human/automation integration within space transportation systems.
Author
Display Devices; Cockpits; Commercial Aircraft; Flight Management Systems; Flight Crews

20040086802 NASA Langley Research Center, Hampton, VA, USA
Single Axis Piezoceramic Gimbal
Horner, Garnett; Taleghani, Barmac; [2001]; 8 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

This paper describes the fabrication, testing, and analysis of a single axis piezoceramic gimbal. The fabrication process consists of pre-stressing a piezoceramic wafer using a high-temperature thermoplastic polyimide and a metal foil. The differential thermal expansion between the ceramic and metal induces a curvature. The pre-stressed, curved piezoceramic is mounted on a support mechanism and a mirror is attached to the piezoceramic. A plot of gimbal angle versus applied voltage to the piezoceramic is presented. A finite element analysis of the piezoceramic gimbal is described. The predicted gimbal angle versus applied voltage is compared to experimental results.
Author
Fabrication; Performance Tests; Gimbals; Piezoelectric Ceramics

20040087108 NASA Langley Research Center, Hampton, VA, USA
X-33 Hypersonic Aerodynamic Characteristics
Murphy, Kelly J.; Nowak, Robert J.; Thompson, Richard A.; Hollis, Brian R.; Prabhu, Ramadas K.; [1999]; 14 pp.; In English; AIAA Atmospheric Flight Mechanics Conference and Exhibit, 9-11 Aug. 1999, Portland, OR, USA
Report No.(s): AIAA Paper 99-4162; Copyright; Avail: CASI; A03, Hardcopy

Lockheed Martin Skunk Works, under a cooperative agreement with NASA, will build and fly the X-33, a half-scale prototype of a rocket-based, single-stage-to-orbit (SSTO), reusable launch vehicle (RLV). A 0.007-scale model of the X-33

604B0002G configuration was tested in four hypersonic facilities at the NASA Langley Research Center to examine vehicle stability and control characteristics and to populate an aerodynamic flight database i n the hypersonic regime. The vehicle was found to be longitudinally controllable with less than half of the total body flap deflection capability across the angle of attack range at both Mach 6 and Mach 10. At these Mach numbers, the vehicle also was shown to be longitudinally stable or neutrally stable for typical (greater than 20 degrees) hypersonic flight attitudes. This configuration was directionally unstable and the use of reaction control jets (RCS) will be necessary to control the vehicle at high angles of attack in the hypersonic flight regime. Mach number and real gas effects on longitudinal aerodynamics were shown to be small relative to X-33 control authority.
Author
Aerodynamic Characteristics; X-33 Reusable Launch Vehicle; Scale Models; Jet Control; Hypersonic Flight; Angle of Attack

20040087354 Federal Aviation Administration, Washington, DC
Airplane Flying Handbook
2004; In English
Report No.(s): PB2004-106962; FAA-H-8083-3A; No Copyright; Avail: National Technical Information Service (NTIS)

The overall purpose of primary and intermediate flight training, as outlined in this handbook, is the acquisition and honing of basic airmanship skills. Airmanship can be defined as: A sound acquaintance with the principles of flight, the ability to operate an airplane with competence and precision both on the ground and in the air, and the exercise of sound judgment that results in optimal operational safety and efficiency.
NTIS
Handbooks; Aircraft Pilots; Flight Training

07
AIRCRAFT PROPULSION AND POWER

Includes primary propulsion systems and related systems and components, e.g., gas turbine engines, compressors, and fuel systems; and onboard auxiliary power plants for aircraft. For related information see also *20 Spacecraft Propulsion and Power; 28 Propellants and Fuels*; and *44 Energy Production and Conversion*.

20040086585 NASA Langley Research Center, Hampton, VA, USA
Development of Field Measurement Systems for Flight Vehicle Noise
Yu, James C.; Wright, Kenneth D.; Preisser, John S.; Marcolini, Michael A.; [1999]; 4 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Field measurement of noise radiated from flight vehicles is an important element of aircraft noise research programs. At NASA Langley, a dedicated effort that spans over two decades was devoted to the development of acoustic measurement systems to support the NASA noise research programs. The new challenge for vehicle operational noise reduction through varying glide slope and flight path require noise measurement to be made over a very large area under the vehicle flight path. Such a challenge can be met through the digital remote system currently under final development at NASA Langley.
Author
Noise Reduction; Acoustic Measurement; Aircraft Engines

20040086689 NASA Langley Research Center, Hampton, VA, USA
Acoustic Energy Estimates in Inhomogeneous Moving Media
Farassat, F.; Farris, Mark; [1999]; 16 pp.; In English; Joint ASA/EAA/DAGA Meeting, 14-19 Mar. 1999, Berlin, Germany; No Copyright; Avail: CASI; A03, Hardcopy

In ducted fan engine noise research, there is a need for defining a simple and easy to use acoustic energy conservation law to help in quantification of noise control techniques. There is a well known conservation law relating acoustic energy and acoustic energy flux in the case of an isentropic irrotational flow. Several different approaches have been taken to generalize this conservation law. For example, Morfey finds an identity by separating out the irrotational part of the perturbed flow. Myers is able to find a series of indentities by observing an algebraic relationship between the basic conservation of energy equation for a background flow and the underlying equations of motion. In an approximate sense, this algebraic relationship is preserved under perturbation. A third approach which seems to have not been pursued in the literature is a result known as Noether's theorem. There is a Lagrangian formulation for the Euler equation of fluid mechanics. Noether's theorem says that any group action that leaves the Lagrangian action invariant leads to a conserved quantity. This presentation will include a survey of

current results regarding acoustic energy and preliminary results on the symmetries of the Lagrangian.
Author
Acoustic Emission; Conservation Laws; Energy Conservation

20040086780 NASA Langley Research Center, Hampton, VA, USA
Three-Dimensional Effects in Modeling of Dual-Mode Scramjets
Rodriquez, C. G.; White, J. A.; Riggins, D. W.; [2000]; 15 pp.; In English
Contract(s)/Grant(s): NASW-4907
Report No.(s): AIAA Paper 2000-3704; Copyright; Avail: CASI; A03, Hardcopy

A numerical investigation of an experimental dual-mode scramjet configuration is performed. Both experimental and numerical results indicate significant upstream interaction for this case. Several computational cases are examined: these include the use of jet-to-jet symmetry and entire half-duct modeling. Grid convergence, turbulence modeling, and wall temperature effects are studied in terms of wall pressure predictions and flow-field characteristics. Wall pressure comparisons between CFD and experiment show fair agreement for the jet-to-jet case. However, further computations of the entire half-duct show the development of a large sidewall separation zone extending much further upstream than the separation zone at the duct centerline. This sidewall separation is the dominant feature in the CFD-generated flowfield but is not evident in the experimental data, resulting in a unfavorable comparison between CFD and experimental data. Current work aimed at resolving this issue and at further understanding asymmetric flow-structures in dual-mode flow-fields is discussed.
Author
Supersonic Combustion Ramjet Engines; Computational Grids; Turbulence Models; Wall Temperature; Flow Characteristics; Wall Pressure; Jet Propulsion

20040086818 NASA Langley Research Center, Hampton, VA, USA
Simulation of Acoustic Scattering from a Trailing Edge
Singer, Bart A.; Brentner, Kenneth S.; Lockhard, David P.; Lilley, Geoffrey M.; [1999]; 13 pp.; In English; 37th Aerospace Sciences Meeting and Exhibit, 11-14 Jan. 1999, Reno, NV, USA
Report No.(s): AIAA Paper 99-0231; Copyright; Avail: CASI; A03, Hardcopy

Three model problems were examined to assess the difficulties involved in using a hybrid scheme coupling flow computation with the the Ffowcs Williams and Hawkings equation to predict noise generated by vortices passing over a sharp edge. The results indicate that the Ffowcs Williams and Hawkings equation correctly propagates the acoustic signals when provided with accurate flow information on the integration surface. The most difficult of the model problems investigated inviscid flow over a two-dimensional thin NACA airfoil with a blunt-body vortex generator positioned at 98 percent chord. Vortices rolled up downstream of the blunt body. The shed vortices possessed similarities to large coherent eddies in boundary layers. They interacted and occasionally paired as they convected past the sharp trailing edge of the airfoil. The calculations showed acoustic waves emanating from the airfoil trailing edge. Acoustic directivity and Mach number scaling are shown.
Author
Computational Fluid Dynamics; Simulation; Acoustic Scattering; Aerodynamic Noise; Mathematical Models; Trailing Edges

20040086838 NASA Langley Research Center, Hampton, VA, USA
A Mode Detection Method Using the Azimuthal Directivity of a Turbofan Model
Thomas, R. H.; Farassat, F.; Clark, L. R.; Gerhold, C. H.; Kelly, J. J.; Becker, L. E.; [1999]; 13 pp.; In English
Report No.(s): AIAA Paper 99-1954; Copyright; Avail: CASI; A03, Hardcopy

The azimuthal, far field directivity of a scale fan model was measured in high resolution. The model is a 12 inch diameter rotor with 16 blades followed by 40 stator vanes. The tests were conducted at the nominal 100% speed corresponding to a tip speed of 905 ft/sec. Measurement of the radiated sound field, forward of the fan, was made in an anechoic chamber with an inflow control device and a baffle separating the aft and forward radiated interaction noise. The acoustic field was surveyed with a circular hoop array of 16 microphones which was moved to 14 axial stations. At each axial station the hoop was rotated in half-degree increments to take 736 points in the azimuthal angle. In addition to sound pressure level, the phase angle relative to a reference microphone was measured at each point. The sound pressure level is shown to vary in patterns by 10-15 dB especially for the fundamental tone but also for the first and second harmonic. A far field mode detection method has been developed and used with the data which determines the modes generated by the fan and which then interact to form the azimuthal directivity.
Author
Acoustic Measurement; Anechoic Chambers; Scale Models; Turbofans

20040086845 NASA Langley Research Center, Hampton, VA, USA

Inlet Noise Reduction by Shielding for the Blended-Wing-Body Airplane

Clark, Lorenzo R.; Gerhold, Carl H.; [1999]; 13 pp.; In English; 5th AIAA/CEAS Aeroacoustics Conference, 10-12 May 1999, Greater Seattle, WA, USA

Report No.(s): AIAA Paper 99-1937; Copyright; Avail: CASI; A03, Hardcopy

Noise shielding benefits associated with an advanced unconventional subsonic transport concept, the Blended-Wing-Body, were studied using a 4- percent scale, 3-engine nacelle model. The study was conducted in the Anechoic Noise Research Facility at NASA Langley Research Center. A high- frequency, wideband point source was placed inside the nacelles of the center engine and one of the side engines in order to simulate broadband engine noise. The sound field of the model was measured with a rotating microphone array that was moved to various stations along the model axis and with a fixed array of microphones that was erected behind the model. Ten rotating microphones were traversed a total of 22 degrees in 2-degree increments. Seven fixed microphones covered an arc that extended from a point in the exhaust exit plane of the center engine (and directly below its centerline) to a point 30 degrees above the jet centerline. While no attempt was made to simulate the noise emission characteristics of an aircraft engine, the model source was intended to radiate sound in a frequency range encompassing 1, 2, and 3 times the blade passage of a typical full-scale engine. In this study, the Blended-Wing-Body model was found to provide significant shielding of inlet noise. In particular, noise radiated downward into the forward sector was reduced by 20 to 25 dB overall in the full-scale frequencies from 2000 to 4000 Hz, decreasing to 10 dB or less at the lower frequencies. Also, it was observed that noise associated with the exhaust radiates into the sector directly below the model downstream to reduce shielding efficiency.

Author

Inlet Nozzles; Aircraft Noise; Engine Noise; Noise Reduction

20040086860 NASA Langley Research Center, Hampton, VA, USA

Flight Test of ASAC Aircraft Interior Noise Control System

Palumbo, Dan; Cabell, Ran; Cline, John; Sullivan, Brenda; [1999]; 11 pp.; In English

Report No.(s): AIAA Paper 99-1933; Copyright; Avail: CASI; A03, Hardcopy

A flight test is described in which an active structural/acoustic control system reduces turboprop induced interior noise on a Raytheon Aircraft Company 1900D airliner. Control inputs to 21 inertial force actuators were computed adaptively using a transform domain version of the multichannel filtered-X LMS algorithm to minimize the mean square response of 32 microphones. A combinatorial search algorithm was employed to optimize placement of the force actuators on the aircraft frame. Both single frequency and multi-frequency results are presented. Reductions of up to 15 dB were obtained at the blade passage frequency (BPF) during single frequency control tests. Simultaneous reductions of the BPF and next 2 harmonics of 10 dB, 2.5 dB and 3.0 dB, were obtained in a multi-frequency test.

Author

Flight Tests; Active Control; Aeroacoustics; Aircraft Noise; Noise Reduction

20040086961 NASA Langley Research Center, Hampton, VA, USA

Tiltrotor Aeroacoustic Code (TRAC) Prediction Assessment and Initial Comparisons with Tram Test Data

Burley, Casey L.; Brooks, Thomas F.; Charles, Bruce D.; McCluer, Megan; [1999]; 16 pp.; In English; 25th European Rotorcraft Forum, 14-16 Sep. 1999, Rome, Italy; No Copyright; Avail: CASI; A03, Hardcopy

A prediction sensitivity assessment to inputs and blade modeling is presented for the TiltRotor Aeroacoustic Code (TRAC). For this study, the non-CFD prediction system option in TRAC is used. Here, the comprehensive rotorcraft code, CAMRAD.Mod1, coupled with the high-resolution sectional loads code HIRES, predicts unsteady blade loads to be used in the noise prediction code WOPWOP. The sensitivity of the predicted blade motions, blade airloads, wake geometry, and acoustics is examined with respect to rotor rpm, blade twist and chord, and to blade dynamic modeling. To accomplish this assessment, an interim input-deck for the TRAM test model and an input-deck for a reference test model are utilized in both rigid and elastic modes. Both of these test models are regarded as near scale models of the V-22 proprotor (tiltrotor). With basic TRAC sensitivities established, initial TRAC predictions are compared to results of an extensive test of an isolated model proprotor. The test was that of the TiltRotor Aeroacoustic Model (TRAM) conducted in the Duits-Nederlandse Windtunnel (DNW). Predictions are compared to measured noise for the proprotor operating over an extensive range of conditions. The variation of predictions demonstrates the great care that must be taken in defining the blade motion. However, even with this variability, the predictions using the different blade modeling successfully capture (bracket) the levels and trends of the noise for conditions ranging from descent to ascent.

Author

Aeroacoustics; Tilt Rotor Aircraft; Aircraft Models; Noise Prediction (Aircraft); Aerodynamic Loads

20040086962 NASA Glenn Research Center, Cleveland, OH, USA

The Evaluation of High Temperature Adhesive Bonding Processes for Rocket Engine Combustion Chamber Applications

McCray, Daniel; Smith, Jeffrey; Rice, Brian; Blohowiak, Kay; Anderson, Robert; Shin, E. Eugene; McCorkle, Linda; Sutter, James; [2003]; 17 pp.; In English; High Temple Workshop 23, 11 Feb. 2003, Jacksonville, FL, USA

Contract(s)/Grant(s): 708-31-16; Copyright; Avail: CASI; A03, Hardcopy

NASA Glenn Research Center is currently evaluating the possibility of using high- temperature polymer matrix composites to reinforce the combustion chamber of a rocket engine. One potential design utilizes a honeycomb structure composed of a PMR-II- 50/M40J 4HS composite facesheet and titanium honeycomb core to reinforce a stainless steel shell. In order to properly fabricate this structure, adhesive bond PMR-II-50 composite. Proper prebond surface preparation is critical in order to obtain an acceptable adhesive bond. Improperly treated surfaces will exhibit decreased bond strength and durability, especially in metallic bonds where interface are susceptible to degradation due to heat and moisture. Most treatments for titanium and stainless steel alloys require the use of strong chemicals to etch and clean the surface. This processes are difficult to perform due to limited processing facilities as well as safety and environmental risks and they do not consistently yield optimum bond durability. Boeing Phantom Works previously developed sol-gel surface preparations for titanium alloys using a PETI-5 based polyimide adhesive. In support of part of NASA Glenn Research Center, UDRI and Boeing Phantom Works evaluated variations of this high temperature sol-gel surface preparation, primer type, and primer cure conditions on the adhesion performance of titanium and stainless steel using Cytec FM 680-1 polyimide adhesive. It was also found that a modified cure cycle of the FM 680-1 adhesive, i.e., 4 hrs at 370 F in vacuum + post cure, significantly increased the adhesion strength compared to the manufacturer's suggested cure cycle. In addition, the surface preparation of the PMR-II-50 composite was evaluated in terms of surface cleanness and roughness. This presentation will discuss the results of strength and durability testing conducted on titanium, stainless steel, and PMR-II-50 composite adherends to evaluate possible bonding processes.

Author

Evaluation; High Temperature; Adhesive Bonding; Rocket Engines; Combustion Chambers; Technology Assessment; Polymer Matrix Composites

20040087005 NASA Langley Research Center, Hampton, VA, USA

XV-15 Tiltrotor Low Noise Approach Operations

Conner, David A.; Marcolini, Michael A.; Decker, William A.; Cline, John H.; Edwards, Bryan D.; Nicks, Colby O.; Klein, Peter D.; [1999]; 15 pp.; In English; American Helicopter Society 55th Annual Forum, 25-27 May 1999, Montreal, Quebec, Canada; No Copyright; Avail: CASI; A03, Hardcopy

Acoustic data have been acquired for the XV-15 tiltrotor aircraft performing approach operations for a variety of different approach profile configurations. This flight test program was conducted jointly by NASA, the U.S. Army, and Bell Helicopter Textron, Inc. (BHTI) in June 1997. The XV-15 was flown over a large area microphone array, which was deployed to directly measure the noise footprint produced during actual approach operations. The XV-15 flew realistic approach profiles that culminated in IGE hover over a landing pad. Aircraft tracking and pilot guidance was provided by a Differential Global Positioning System (DGPS) and a flight director system developed at BHTI. Approach profile designs emphasized noise reduction while maintaining handling qualities sufficient for tiltrotor commercial passenger ride comfort and flight safety under Instrument Flight Rules (IFR) conditions. A discussion of the approach profile design philosophy is provided. Five different approach profiles are discussed in detail -- 3 deg., 6 deg., and 9 deg. approaches, and two very different 3 deg. to 9 deg. segmented approaches. The approach profile characteristics are discussed in detail, followed by the noise footprints and handling qualities. Sound exposure levels are also presented on an averaged basis and as a function of the sideline distance for a number of up-range distances from the landing point. A comparison of the noise contour areas is also provided. The results document the variation in tiltrotor noise due to changes in operating condition, and indicate the potential for significant noise reduction using the unique tiltrotor capability of nacelle tilt.

Author

Xv-15 Aircraft; Acoustic Properties; Data Acquisition; Test Vehicles; Flight Tests; Noise Reduction

20040087135 Honeywell Engines, Systems and Services, Phoenix, AZ, USA

Reliable and Affordable Control Systems Active Combustor Pattern Factor Control

McCarty, Bob; Tomondi, Chris; McGinley, Ray; July 2004; 336 pp.; In English

Contract(s)/Grant(s): NAS3-27752; WBS 714-20-04

Report No.(s): NASA/CR-2004-213097; E-14572; Rept-21-11165; No Copyright; Avail: CASI; A15, Hardcopy

Active, closed-loop control of combustor pattern factor is a cooperative effort between Honeywell (formerly AlliedSignal) Engines and Systems and the NASA Glenn Research Center to reduce emissions and turbine-stator vane temperature variations, thereby enhancing engine performance and life, and reducing direct operating costs. Total fuel flow supplied to the engine is established by the speed/power control, but the distribution to individual atomizers will be controlled by the Active Combustor Pattern Factor Control (ACPFC). This system consist of three major components: multiple, thin-film sensors located on the turbine-stator vanes; fuel-flow modulators for individual atomizers; and control logic and algorithms within the electronic control.
Author
Active Control; Electronic Control; Combustion Chambers; Turbines; Stators; Vanes

20040087136 NASA Glenn Research Center, Cleveland, OH, USA
An Experiment on the Near Flow Field of the GE/ARL Mixer Ejector Nozzle
Zaman, K. B. M. Q.; July 2004; 58 pp.; In English
Contract(s)/Grant(s): WBS 714-09-46
Report No.(s): NASA/TM-2004-213113; E-14589; No Copyright; Avail: CASI; A04, Hardcopy
This report is a documentation of the results on flowfield surveys for the GE/ARL mixer-ejector nozzle carried out in an open jet facility at NASA Glenn Research Center. The results reported are for cold (unheated) flow without any surrounding co-flowing stream. Distributions of streamwise vorticity as well as turbulent stresses, obtained by hot-wire anemometry, are presented for a low subsonic condition. Pitot probe survey results are presented for nozzle pressure ratios up to 3.5. Flowfields both inside and outside of the ejector are considered. Inside the ejector, the mean velocity distribution exhibits a cellular pattern on the cross sectional plane, originating from the flow through the primary and secondary chutes. With increasing downstream distance an interchange of low velocity regions with adjacent high velocity regions takes place due to the action of the streamwise vortices. At the ejector exit, the velocity distribution is nonuniform at low and high pressure ratios but reasonably uniform at intermediate pressure ratios. The effects of two chevron configurations and a tab configuration on the evolution of the downstream jet are also studied. Compared to the baseline case, minor but noticeable effects are observed on the flowfield.
Author
Flow Distribution; Ejectors; Turbulence; Mixers; Tabs (Control Surfaces)

20040087138 NYMA, Inc., Brook Park, OH, USA
Analysis of Fuel Vaporization, Fuel-Air Mixing, and Combustion in Integrated Mixer-Flame Holders
Deur, J. M.; Cline, M. C.; July 2004; 39 pp.; In English
Contract(s)/Grant(s): NAS3-27235; WBS 714-09-46
Report No.(s): NASA/CR-2004-213116; E-14610; No Copyright; Avail: CASI; A03, Hardcopy
Requirements to limit pollutant emissions from the gas turbine engines for the future High-Speed Civil Transport (HSCT) have led to consideration of various low-emission combustor concepts. One such concept is the Integrated Mixer-Flame Holder (IMFH). This report describes a series of IMFH analyses performed with KIVA-II, a multi-dimensional CFD code for problems involving sprays, turbulence, and combustion. To meet the needs of this study, KIVA-II's boundary condition and chemistry treatments are modified. The study itself examines the relationships between fuel vaporization, fuel-air mixing, and combustion. Parameters being considered include: mixer tube diameter, mixer tube length, mixer tube geometry (converging-diverging versus straight walls), air inlet velocity, air inlet swirl angle, secondary air injection (dilution holes), fuel injection velocity, fuel injection angle, number of fuel injection ports, fuel spray cone angle, and fuel droplet size. Cases are run with and without combustion to examine the variations in fuel-air mixing and potential for flashback due to the above parameters. The degree of fuel-air mixing is judged by comparing average, minimum, and maximum fuel/air ratios at the exit of the mixer tube, while flame stability is monitored by following the location of the flame front as the solution progresses from ignition to steady state. Results indicate that fuel-air mixing can be enhanced by a variety of means, the best being a combination of air inlet swirl and a converging-diverging mixer tube geometry. With the IMFH configuration utilized in the present study, flashback becomes more common as the mixer tube diameter is increased and is instigated by disturbances associated with the dilution hole flow.
Author
Gas Turbine Engines; Flame Holders; Vaporizing; Combustion; Computational Fluid Dynamics; Mixers; Fuel Injection; Convergent-Divergent Nozzles

20040087139 General Electric Aircraft Engines, Cincinnati, OH, USA
Acoustic, Flow Related, and Performance Related Experimental Results for Generation 1.5 High Speed Civil Transport (HSCT) 2-Dimensional Exhaust Nozzles
Salikuddin, M.; Wisler, S.; Majjigi, R.; July 2004; 517 pp.; In English
Contract(s)/Grant(s): NAS3-26617; WBS 714-09-46
Report No.(s): NASA/CR-2004-213117; E-14611; No Copyright; Avail: CASI; A22, Hardcopy

The principle objectives of the current program were to experimentally investigate the repeatability of acoustic and aerodynamic characteristics of 2D-CD mixer-ejector nozzles and the effects on the acoustic and aerodynamic characteristics of 2D mixer-ejectors due to (1) the configurational variations, which include mixers with aligned CD chutes, aligned convergent chutes, and staggered CD chutes and aerodynamic cycle variables, (2) treatment variations by using different treatment materials, treating the ejector with varying area, location, and treatment thickness for a mixer-ejector configuration, and (3) secondary inlet shape (i.e., a more realistic inlet) and the blockage across the inlet (a possible fin-like structure needed for installation purpose) by modifying one of the inlet of a mixer-ejector configuration. The objectives also included the measurement dynamic pressures internal to the ejector for a few selected configuration to examine the internal noise characteristics.
Author
Exhaust Nozzles; Supersonic Transports; Chutes; Ejectors; Mixers; Aerodynamic Characteristics; Noise Measurement; Sound Waves

20040087140 United Technologies Corp., West Palm Beach, FL, USA
Inlet Flow Valve Engine Analyses
Champagne, G. A.; July 2004; 160 pp.; In English
Contract(s)/Grant(s): NAS3-26618; WBS 714-09-46
Report No.(s): NASA/CR-2004-213119; E-14613; No Copyright; Avail: CASI; A08, Hardcopy

Pratt&Whitney, under Task Order 13 of the NASA Large Engine Technology (LET) Contract, conducted a study to determine the operating characteristics, performance and weights of Inlet Flow Valve (IFV) propulsion concepts for a Mach 2.4 High Speed Civil Transport (HSCT).
Author
Inlet Flow; Gas Turbine Engines; Propulsion; Supersonic Transports; Engine Design

20040087141 NASA Glenn Research Center, Cleveland, OH, USA
Parametric Study of a Mach 2.4 Transport Engine with Supersonic Through-Flow Rotor and Supersonic Counter-Rotating Diffuser (SSTR/SSCRD)
Tran, Donald H.; August 2004; 29 pp.; In English
Contract(s)/Grant(s): NAS3-27235; WBS 714-09-46
Report No.(s): NASA/TM-2004-213139; No Copyright; Avail: CASI; A03, Hardcopy

A parametric study is conducted to evaluate a mixed-flow turbofan equipped with a supersonic through-flow rotor and a supersonic counter-rotating diffuser (SSTR/SSCRD) for a Mach 2.4 civil transport. Engine cycle, weight, and mission analyses are performed to obtain a minimum takeoff gross weight aircraft. With the presence of SSTR/SSCRD, the inlet can be shortened to provide better pressure recovery. For the same engine airflow, the inlet, nacelle, and pylon weights are estimated to be 73 percent lighter than those of a conventional inlet. The fan weight is 31 percent heavier, but overall the installed engine pod weight is 11 percent lighter than the current high-speed civil transport baseline conventional mixed-flow turbofan. The installed specific fuel consumption of the supersonic fan engine is 2 percent higher than that of the baseline turbofan at supersonic cruise. Finally, the optimum SSTR/SSCRD airplane meets the FAR36 Stage 3 noise limit and is within 7 percent of the baseline turbofan airplane takeoff gross weight over a 5000-n mi mission.
Author
Gas Turbine Engines; Supersonic Diffusers; Engine Inlets; Turbofans; Supersonic Flow; Air Flow

20040087355 NASA Langley Research Center, Hampton, VA, USA
Quantification of Inlet Impedance Concept and a Study of the Rayleigh Formula for Noise Radiation from Ducted Fan Engines
Posey, Joe W.; Dunn, M. H.; Farassat, F.; [2004]; 14 pp.; In English; 4th AIAA/CEAS Aeroacoustics Conference, 2-4 Jun. 1998, Toulouse, France
Report No.(s): AIAA Paper 98-2248; Copyright; Avail: CASI; A03, Hardcopy

This paper addresses two aspects of duct propagation and radiation which can contribute to more efficient fan noise predictions. First, we assess the effectiveness of Rayleigh's formula as a ducted fan noise prediction tool. This classical result which predicts the sound produced by a piston in a flanged duct is expanded to include the uniform axial inflow case. Radiation patterns using Rayleigh's formula with single radial mode input are compared to those obtained from the more precise ducted fan noise prediction code TBIEM3D. Agreement between the two methods is excellent in the peak noise regions both forward and aft. Next, we use TBIEM3D to calculate generalized radiation impedances and power transmission coefficients. These quantities are computed for a wide range of operating parameters. Results were obtained for higher Mach numbers, frequencies, and circumferential mode orders than have been previously published. Viewed as functions of frequency, calculated trends in lower order inlet impedances and power transmission coefficients are in agreement with known results. The relationships are more oscillatory for higher order modes and higher Mach numbers.
Author
Aerodynamic Noise; Ducted Fan Engines; Ducts; Frequencies; Impedance; Sound Waves

08
AIRCRAFT STABILITY AND CONTROL

Includes flight dynamics, aircraft handling qualities, piloting, flight controls, and autopilots. For related information see also *05 Aircraft Design, Testing and Performance* and *06 Avionics and Aircraft Instrumentation*.

20040086633 NASA Langley Research Center, Hampton, VA, USA
Buffet Load Alleviation
Ryall, T. G.; Moses, R. W.; Hopkins, M. A.; Henderson, D.; Zimcik, D. G.; Nitzsche, F.; [2004]; 7 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy
High performance aircraft are, by their very nature, often required to undergo maneuvers involving high angles of attack. Under these conditions unsteady vortices emanating from the wing and the fuselage will impinge on the twin fins (required for directional stability) causing excessive buffet loads, in some circumstances, to be applied to the aircraft. These loads result in oscillatory stresses, which may cause significant amounts of fatigue damage. Active control is a possible solution to this important problem. A full-scale test was carried out on an F/A-18 fuselage and fins using piezoceramic actuators to control the vibrations. Buffet loads were simulated using very powerful electromagnetic shakers. The first phase of this test was concerned with the open loop system identification whereas the second stage involved implementing linear time invariant control laws. This paper looks at some of the problems encountered as well as the corresponding solutions and some results. It is expected that flight trials of a similar control system to alleviate buffet will occur as early as 2001.
Author
Active Control; Vortices; Vibration; Full Scale Tests; Fatigue (Materials); Body-Wing Configurations

20040086693 NASA Langley Research Center, Hampton, VA, USA
Optimum Actuator Selection with a Genetic Algorithm for Aircraft Control
Rogers, James L.; [2004]; 6 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy
The placement of actuators on a wing determines the control effectiveness of the airplane. One approach to placement maximizes the moments about the pitch, roll, and yaw axes, while minimizing the coupling. For example, the desired actuators produce a pure roll moment without at the same time causing much pitch or yaw. For a typical wing, there is a large set of candidate locations for placing actuators, resulting in a substantially larger number of combinations to examine in order to find an optimum placement satisfying the mission requirements and mission constraints. A genetic algorithm has been developed for finding the best placement for four actuators to produce an uncoupled pitch moment. The genetic algorithm has been extended to find the minimum number of actuators required to provide uncoupled pitch, roll, and yaw control. A simplified, untapered, unswept wing is the model for each application.
Author
Actuators; Aircraft Control; Genetic Algorithms; Wings; Aircraft Models

20040086790 NASA Langley Research Center, Hampton, VA, USA
Numerical Modeling Studies of Wake Vortices: Real Case Simulations
Shen, Shao-Hua; Ding, Feng; Han, Jongil; Lin, Yuh-Lang; Arya, S. Pal; Proctor, Fred H.; [1999]; 17 pp.; In English; 37th AIAA Aerospace Sciences Meeting and Exhibit, 11-14 Jan. 1999, Reno, NV, USA
Contract(s)/Grant(s): NCC1-188
Report No.(s): AIAA Paper 99-0755; Copyright; Avail: CASI; A03, Hardcopy

A three-dimensional large-eddy simulation model, TASS, is used to simulate the behavior of aircraft wake vortices in a real atmosphere. The purpose for this study is to validate the use of TASS for simulating the decay and transport of wake vortices. Three simulations are performed and the results are compared with the observed data from the 1994-1995 Memphis field experiments. The selected cases have an atmospheric environment of weak turbulence and stable stratification. The model simulations are initialized with appropriate meteorological conditions and a post roll-up vortex system. The behavior of wake vortices as they descend within the atmospheric boundary layer and interact with the ground is discussed.
Author
Mathematical Models; Wakes; Vortices; Large Eddy Simulation; Aircraft Wakes

20040086829 NASA Langley Research Center, Hampton, VA, USA
Transonic Flutter Suppression Control Law Design Using Classical and Optimal Techniques with Wind-Tunnel Results
Mukhopadhyay, Vivek; [1999]; 12 pp.; In English; 40th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials (SDM) Conference, 12-15 Apr. 1999, Saint Louis, MO, USA
Report No.(s): AIAA Paper 99-1396; Copyright; Avail: CASI; A03, Hardcopy

The benchmark active controls technology and wind tunnel test program at NASA Langley Research Center was started with the objective to investigate the nonlinear, unsteady aerodynamics and active flutter suppression of wings in transonic flow. The paper will present the flutter suppression control law design process, numerical nonlinear simulation and wind tunnel test results for the NACA 0012 benchmark active control wing model. The flutter suppression control law design processes using (1) classical, (2) linear quadratic Gaussian (LQG), and (3) minimax techniques are described. A unified general formulation and solution for the LQG and minimax approaches, based on the steady state differential game theory is presented. Design considerations for improving the control law robustness and digital implementation are outlined. It was shown that simple control laws when properly designed based on physical principles, can suppress flutter with limited control power even in the presence of transonic shocks and flow separation. In wind tunnel tests in air and heavy gas medium, the closed-loop flutter dynamic pressure was increased to the tunnel upper limit of 200 psf. The control law robustness and performance predictions were verified in highly nonlinear flow conditions, gain and phase perturbations, and spoiler deployment. A non-design plunge instability condition was also successfully suppressed.
Author
Transonic Flutter; Active Control; Unsteady Aerodynamics; Linear Quadratic Gaussian Control

20040086830 NASA Langley Research Center, Hampton, VA, USA
Control Law Synthesis for Vertical Fin Buffeting Alleviation Using Strain Actuation
Nitzsche, F.; Zimcik, D. G.; Ryall, T. G.; Moses, R. W.; Henderson, D. A.; [1999]; 6 pp.; In English
Report No.(s): AIAA Paper 99-1317; Copyright; Avail: CASI; A02, Hardcopy

In the present investigation, the results obtained during the ground test of a closed-loop control system conducted on a full-scale fighter to attenuate vertical fin buffeting response using strain actuation are presented. Two groups of actuators consisting of piezoelectric elements distributed over the structure were designed to achieve authority over the first and second modes of the vertical fin. The control laws were synthesized using the Linear Quadratic Gaussian (LQG) method for a time-invariant control system. Three different pairs of sensors including strain gauges and accelerometers at different locations were used to close the feedback loop. The results demonstrated that measurable reductions in the root-mean-square (RMS) values of the fin dynamic response identified by the strain transducer at the critical point for fatigue at the root were achieved under the most severe buffet condition. For less severe buffet conditions, reductions of up to 58% were achieved.
Author
Fins; Ground Tests; Linear Quadratic Gaussian Control; Dynamic Response

20040086835 NASA Langley Research Center, Hampton, VA, USA
Experimental Investigation of Convoluted Contouring for Aircraft Afterbody Drag Reduction
Deere, Karen A.; Hunter, Craig A.; [1999]; 11 pp.; In English; 35th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 20-24 Jun. 1999, Los Angeles, CA, USA
Report No.(s): AIAA Paper 99-2670; Copyright; Avail: CASI; A03, Hardcopy

An experimental investigation was performed in the NASA Langley 16-Foot Transonic Tunnel to determine the aerodynamic effects of external convolutions, placed on the boattail of a nonaxisymmetric nozzle for drag reduction. Boattail angles of 15 and 22 were tested with convolutions placed at a forward location upstream of the boattail curvature, at a mid location along the curvature and at a full location that spanned the entire boattail flap. Each of the baseline nozzle afterbodies

(no convolutions) had a parabolic, converging contour with a parabolically decreasing corner radius. Data were obtained at several Mach numbers from static conditions to 1.2 for a range of nozzle pressure ratios and angles of attack. An oil paint flow visualization technique was used to qualitatively assess the effect of the convolutions. Results indicate that afterbody drag reduction by convoluted contouring is convolution location, Mach number, boattail angle, and NPR dependent. The forward convolution location was the most effective contouring geometry for drag reduction on the 22 afterbody, but was only effective for M \h 0.95. At M = 0.8, drag was reduced 20 and 36 percent at NPRs of 5.4 and 7, respectively, but drag was increased 10 percent for M = 0.95 at NPR = 7. Convoluted contouring along the 15 boattail angle afterbody was not effective at reducing drag because the flow was minimally separated from the baseline afterbody, unlike the massive separation along the 22 boattail angle baseline afterbody.
Author
Convulsions; Experimentation; Afterbodies; Drag Reduction; Aerodynamic Drag

20040086841 NASA Langley Research Center, Hampton, VA, USA
Determination of Stability and Control Derivatives using Computational Fluid Dynamics and Automatic Differentiation
Park, Michael A.; Green, Lawrence L.; Montgomery, Raymond C.; Raney, David L.; [1999]; 18 pp.; In English
Report No.(s): AIAA Paper 99-3136; Copyright; Avail: CASI; A03, Hardcopy

With the recent interest in novel control effectors there is a need to determine the stability and control derivatives of new aircraft configurations early in the design process. These derivatives are central to most control law design methods and would allow the determination of closed-loop control performance of the vehicle. Early determination of the static and dynamic behavior of an aircraft may permit significant improvement in configuration weight, cost, stealth, and performance through multidisciplinary design. The classical method of determining static stability and control derivatives - constructing and testing wind tunnel models - is expensive and requires a long lead time for the resultant data. Wind tunnel tests are also limited to the preselected control effectors of the model. To overcome these shortcomings, computational fluid dynamics (CFD) solvers are augmented via automatic differentiation, to directly calculate the stability and control derivatives. The CFD forces and moments are differentiated with respect to angle of attack, angle of sideslip, and aircraft shape parameters to form these derivatives. A subset of static stability and control derivatives of a tailless aircraft concept have been computed by two differentiated inviscid CFD codes and verified for accuracy with central finite-difference approximations and favorable comparisons to a simulation database.
Author
Static Stability; Stability Derivatives; Aircraft Control; Aircraft Configurations; Dynamic Characteristics

20040090579 NASA Langley Research Center, Hampton, VA, USA
Application of Forebody Strakes for Directional Stability and Control of Transport Aircraft
Shah, Gautam H.; Granda, J. Nijel; [1998]; 9 pp.; In English
Report No.(s): AIAA Paper 98-4448; Copyright; Avail: CASI

A brief overview of a cooperative NASA/Boeing research effort, Strake Technology Research Application to Transport Aircraft (STRATA), intended to explore the potential of applying forebody strake technology to transport aircraft configurations for directional stability and control at low angles of attack, is presented. As an initial step in the STRATA program, an exploratory wind-tunnel investigation of the effect of fixed forebody strakes on the directional stability and control characteristics of a generic transport configuration was conducted in the NASA Langley 12-Foot Low-Speed Wind Tunnel. Results of parametric variations in strake chord and span, as well as the effect of strake incidence, are presented. The use of strakes for yaw control is also discussed. Results emphasize the importance of forebody/fuselage crossflow in influencing strake effectiveness. Strake effectiveness is also seen to be directly related to its span, but less sensitive to chord; a very short-chord strake with sufficient span can have a significant effect.
Author
Directional Stability; Forebodies; Strakes; Transport Aircraft; Aircraft Configurations; Controllability; Subsonic Wind Tunnels

20040090583 NASA Langley Research Center, Hampton, VA, USA
An Atmospheric Guidance Algorithm Testbed for the Mars Surveyor Program 2001 Orbiter and Lander
Striepe, Scott A.; Queen, Eric M.; Powell, Richard W.; Braun, Robert D.; Cheatwood, F. McNeil; Aguirre, John T.; Sachi, Laura A.; Lyons, Daniel T.; [1998]; 14 pp.; In English; AIAA Atmospheric Flight Mechanics Conference, 10-12 Aug. 1998, Boston, MA, USA
Report No.(s): AIAA Paper 98-4569; Copyright; Avail: CASI; A03, Hardcopy

An Atmospheric Flight Team was formed by the Mars Surveyor Program ‘01 mission office to develop aerocapture and precision landing testbed simulations and candidate guidance algorithms. Three- and six-degree-of-freedom Mars atmospheric flight simulations have been developed for testing, evaluation, and analysis of candidate guidance algorithms for the Mars Surveyor Program 2001 Orbiter and Lander. These simulations are built around the Program to Optimize Simulated Trajectories. Subroutines were supplied by Atmospheric Flight Team members for modeling the Mars atmosphere, spacecraft control system, aeroshell aerodynamic characteristics, and other Mars 2001 mission specific models. This paper describes these models and their perturbations applied during Monte Carlo analyses to develop, test, and characterize candidate guidance algorithms.
Author
Algorithms; Mars Surveyor 2001 Mission; Flight Simulation; Spacecraft Guidance; Atmospheric Models; Mars Landing

20040090584 NASA Langley Research Center, Hampton, VA, USA
Numerical Roll Reversal Predictor Corrector Aerocapture and Precision Landing Guidance Algorithms for the Mars Surveyor Program 2001 Missions
Powell, Richard W.; [1998]; 10 pp.; In English; AIAA Atmospheric Flight Mechanics Conference, 10-12 Aug. 1998, Boston, MA, USA
Report No.(s): AIAA Paper 98-4574; Copyright; Avail: CASI; A02, Hardcopy

This paper describes the development and evaluation of a numerical roll reversal predictor-corrector guidance algorithm for the atmospheric flight portion of the Mars Surveyor Program 2001 Orbiter and Lander missions. The Lander mission utilizes direct entry and has a demanding requirement to deploy its parachute within 10 km of the target deployment point. The Orbiter mission utilizes aerocapture to achieve a precise captured orbit with a single atmospheric pass. Detailed descriptions of these predictor-corrector algorithms are given. Also, results of three and six degree-of-freedom Monte Carlo simulations which include navigation, aerodynamics, mass properties and atmospheric density uncertainties are presented.
Author
Aerocapture; Aircraft Guidance; Aircraft Landing; Algorithms; Mars Surveyor 2001 Mission; Predictor-Corrector Methods

09
RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, runways, hangars, and aircraft repair and overhaul facilities; wind tunnels, water tunnels, and shock tubes; flight simulators; and aircraft engine test stands. Also includes airport ground equipment and systems. For airport ground operations see *03 Air Transportation and Safety*. For astronautical facilities see *14 Ground Support Systems and Facilities (Space)*.

20040086717 NASA Langley Research Center, Hampton, VA, USA
Control of the NASA Langley 16-Foot Transonic Tunnel with the Self-Organizing Map
Motter, Mark A.; [1999]; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

A predictive, multiple model control strategy is developed based on an ensemble of local linear models of the nonlinear system dynamics for a transonic wind tunnel. The local linear models are estimated directly from the weights of a self-organizing map (SOM). Multiple self-organizing maps collectively model the global response of the wind tunnel to a finite set of representative prototype controls. These prototype controls partition the control space and incorporate experiential knowledge gained from decades of operation. Each SOM models the combination of the tunnel with one of the representative controls, over the entire range of operation. The SOM based linear models are used to predict the tunnel response to a larger family of control sequences which are clustered on the representative prototypes. The control sequence which corresponds to the prediction that best satisfies the requirements on the system output is applied as the external driving signal.
Author
Transonic Wind Tunnels; Sequential Control; Nonlinear Systems

20040086752 NASA Langley Research Center, Hampton, VA, USA
Improved Correction System for Vibration Sensitive Inertial Angle of Attack Measurement Devices
Crawford, Bradley L.; Finley, Tom D.; [2000]; 10 pp.; In English; 38th Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2000, Reno, NV, USA
Report No.(s): AIAA Paper 2000-0415; Copyright; Avail: CASI; A02, Hardcopy

Inertial angle of attack (AoA) devices currently in use at NASA Langley Research Center (LaRC) are subject to inaccuracies due to centrifugal accelerations caused by model dynamics, also known as sting whip. Recent literature suggests

that these errors can be as high as 0.25 deg. With the current AoA accuracy target at LaRC being 0.01 deg., there is a dire need for improvement. With other errors in the inertial system (temperature, rectification, resolution, etc.) having been reduced to acceptable levels, a system is currently being developed at LaRC to measure and correct for the sting-whip-induced errors. By using miniaturized piezoelectric accelerometers and magnetohydrodynamic rate sensors, not only can the total centrifugal acceleration be measured, but yaw and pitch dynamics in the tunnel can also be characterized. These corrections can be used to determine a tunnel's past performance and can also indicate where efforts need to be concentrated to reduce these dynamics. Included in this paper are data on individual sensors, laboratory testing techniques, package evaluation, and wind tunnel test results on a High Speed Research (HSR) model in the Langley 16-Foot Transonic Wind Tunnel.
Author
Correction; Errors; Transonic Wind Tunnels; Measuring Instruments

20040086817 NASA Langley Research Center, Hampton, VA, USA
Recent Cycle Time Reduction at Langley Research Center
Kegelman, Jerome T.; [1999]; 13 pp.; In English
Report No.(s): AIAA Paper 99-0178; Copyright; Avail: CASI; A03, Hardcopy

The NASA Langley Research Center (LaRC) has been engaged in an effort to reduce wind tunnel test cycle time in support of Agency goals and to satisfy the wind tunnel testing needs of the commercial and military aerospace communities. LaRC has established the Wind Tunnel Enterprise (WTE), with goals of reducing wind tunnel test cycle time by an order of magnitude by 2002, and by two orders of magnitude by 2010. The WTE also plans to meet customer expectations for schedule integrity, as well as data accuracy and quality assurance. The WTE has made progress towards these goals over the last year with a focused effort on technological developments balanced by attention to process improvements. This paper presents a summary of several of the WTE activities over the last year that are related to test cycle time reductions at the Center. Reducing wind tunnel test cycle time, defined here as the time between the freezing of loft lines and delivery of test data, requires that the relationship between high productivity and data quality assurance be considered. The efforts have focused on all of the drivers for test cycle time reduction, including process centered improvements, facility upgrades, technological improvements to enhance facility readiness and productivity, as well as advanced measurement techniques. The application of internet tools and computer modeling of facilities to allow a virtual presence of the customer team is also presented.
Author
NASA Programs; Testing Time; Test Facilities

20040086826 NASA Langley Research Center, Hampton, VA, USA
NASA Aircraft Vortex Spacing System Development Status
Hinton, David A.; Charnock, James K.; Bagwell, Donald R.; Grigsby, Donner; [1999]; 18 pp.; In English; 37th AIAA Aerospace Sciences Meeting and Exhibit, 11-14 Jan. 1999, Reno, NV, USA
Report No.(s): AIAA Paper 99-0753; Copyright; Avail: CASI; A03, Hardcopy

The National Aeronautics and Space Administration (NASA) is addressing airport capacity enhancements during instrument meteorological conditions through the Terminal Area Productivity (TAP) program. Within TAP, the Reduced Spacing Operations (RSO) subelement at the NASA Langley Research Center is developing an Aircraft VOrtex Spacing System (AVOSS). AVOSS will integrate the output of several systems to produce weather dependent, dynamic wake vortex spacing criteria. These systems provide current and predicted weather conditions, models of wake vortex transport and decay in these weather conditions, and real-time feedback of wake vortex behavior from sensors. The goal of the NASA program is to provide the research and development to demonstrate an engineering model AVOSS in real-time operation at a major airport. The demonstration is only of concept feasibility, and additional effort is required to deploy an operational system for actual aircraft spacing reduction. This paper describes the AVOSS system architecture, a wake vortex facility established at the Dallas-Fort Worth International Airport (DFW), initial operational experience with the AVOSS system, and emerging considerations for subsystem requirements. Results of the initial system operation suggest a significant potential for reduced spacing.
Author
Aircraft Approach Spacing; Airports; NASA Programs; Vortices; Systems Engineering

20040086877 NASA Langley Research Center, Hampton, VA, USA
Predictive Multiple Model Switching Control with the Self-Organizing Map
Motter, Mark A.; [2000]; 6 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

A predictive, multiple model control strategy is developed by extension of self-organizing map (SOM) local dynamic modeling of nonlinear autonomous systems to a control framework. Multiple SOMs collectively model the global response of a nonautonomous system to a finite set of representative prototype controls. Each SOM provides a codebook representation of the dynamics corresponding to a prototype control. Different dynamic regimes are organized into topological neighborhoods where the adjacent entries in the codebook represent the global minimization of a similarity metric. The SOM is additionally employed to identify the local dynamical regime, and consequently implements a switching scheme that selects the best available model for the applied control. SOM based linear models are used to predict the response to a larger family of control sequences which are clustered on the representative prototypes. The control sequence which corresponds to the prediction that best satisfies the requirements on the system output is applied as the external driving signal.
Author
Nonlinear Systems; Automatic Control; Control Systems Design; Self Organizing Systems; Sequential Control; Dynamic Models

20040086990 NASA Langley Research Center, Hampton, VA, USA
The NOAA-9 Earth Radiation Budget Experiment Wide Field-of-View Data Set
Bush, Kathryn A.; Smith, G. Louis; Young, David F.; [1999]; 4 pp.; In English
Contract(s)/Grant(s): NAS1-19579; NAG1-1959; No Copyright; Avail: CASI; A01, Hardcopy

The Earth Radiation Budget Experiment (ERBE) consisted of wide field-of-view (WFOV) radiometers and scanning radiometers for measuring outgoing longwave radiation and solar radiation reflected from the Earth. These instruments were carried by the dedicated Earth Radiation Budget Satellite (ERBS) and by the NOAA-9 and -10 operational spacecraft. The WFOV radiometers provided data from which instantaneous fluxes at the top of the atmosphere (TOA) are computed by use of a numerical filter algorithm. Monthly mean fluxes over a 5-degree equal angle grid are computed from the instantaneous TOA fluxes. The WFOV radiometers aboard the NOAA-9 spacecraft operated from February 1985 through December 1992, at which time a failure of the shortwave radiometer ended the usable data after nearly 8 years. This paper examines the monthly mean products from that data set.
Derived from text
Earth Radiation Budget; Earth Radiation Budget Experiment; Solar Radiation

20040087042 NASA Langley Research Center, Hampton, VA, USA
Airborne Separation Assurance and Traffic Management: Research of Concepts and Technology
Ballin, Mark G.; Wing, David J.; Hughes, Monica F.; Conway, Sheila R.; [1999]; 12 pp.; In English
Report No.(s): AIAA Paper 99-3989; Copyright; Avail: CASI; A03, Hardcopy

To support the need for increased flexibility and capacity in the future National Airspace System, NASA is pursuing an approach that distributes air traffic separation and management tasks to both airborne and ground-based systems. Details of the distributed operations and the benefits and technical challenges of such a system are discussed. Technology requirements and research issues are outlined, and NASA s approach for establishing concept feasibility, which includes development of the airborne automation necessary to support the concept, is described.
Author
Air Traffic Control; Feasibility; Flexibility; Management Analysis

20040090464 NASA Langley Research Center, Hampton, VA, USA
Experimental Supersonic Combustion Research at NASA Langley
Rogers, R. Clayton; Capriotti, Diego P.; Guy, R. Wayne; [1998]; 24 pp.; In English; 20th AIAA Advanced Measurement and Groud Testing Technology Conference, 15-18 Jun. 1998, Albuquerque, NM, USA
Report No.(s): AIAA Paper 98-2506; Copyright; Avail: CASI; A03, Hardcopy

Experimental supersonic combustion research related to hypersonic airbreathing propulsion has been actively underway at NASA Langley Research Center (LaRC) since the mid-1960's. This research involved experimental investigations of fuel injection, mixing, and combustion in supersonic flows and numerous tests of scramjet engine flowpaths in LaRC test facilities simulating flight from Mach 4 to 8. Out of this research effort has come scramjet combustor design methodologies, ground test techniques, and data analysis procedures. These technologies have progressed steadily in support of the National Aero-Space Plane (NASP) program and the current Hyper-X flight demonstration program. During NASP nearly 2500 tests of 15 scramjet engine models were conducted in LaRC facilities. In addition, research supporting the engine flowpath design investigated ways to enhance mixing, improve and apply nonintrusive diagnostics, and address facility operation. Tests of

scramjet combustor operation at conditions simulating hypersonic flight at Mach numbers up to 17 also have been performed in an expansion tube pulse facility. This paper presents a review of the LaRC experimental supersonic combustion research efforts since the late 1980's, during the NASP program, and into the Hyper-X Program.
Author
Research Facilities; Supersonic Combustion Ramjet Engines; Supersonic Combustion; Engine Tests

12
ASTRONAUTICS (GENERAL)

Includes general research topics related to space flight and manned and unmanned space vehicles, platforms or objects launched into, or assembled in, outer space; and related components and equipment. Also includes manufacturing and maintenance of such vehicles or platforms. For specific topics in astronautics see *categories 13 through 20*. For extraterrestrial exploration see *91 Lunar and Planetary Science and Exploration*.

20040086115 Air Univ., Maxwell AFB, AL
Technology Challenges for Operationally Responsive Spacelift
Brown, Kendall K.; Jul. 2003; 44 pp.; In English
Report No.(s): AD-A424412; No Copyright; Avail: CASI; A03, Hardcopy

Space has become a critical part of the USA' warfighting capability and requires that future space systems become more responsive than the current systems of reusable and expendable launch vehicles. The US military relies on space assets for communication, navigation, and intelligence, surveillance, and reconnaissance. Our adversaries also recognize our reliance on space technology and are moving forward to deny us the use of those systems. To reduce our vulnerability to those threats, the USA must have the ability to responsively replace, supplement, and service its space assets. Although the development and operational use of systems that will support the evolving mission areas of space control and force application will be subject to political and fiscal leadership decisions, they will also require responsive spacelift capabilities and it is prudent to include those considerations in spacelift planning.
DTIC
Aerospace Engineering; Aerospace Systems; Launch Vehicles

20040086988 NASA Langley Research Center, Hampton, VA, USA
Mir Environmental Effects Payload and Returned Mir Solar Panel Cleanliness
Harvey, Gale A.; Humes, Donald H.; Kinard, William H.; [2000]; 13 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

The MIR Environmental Effects Payload (MEEP) was attached to the Docking Module of the MIR space station for 18 months during calendar years 1996 and 1997 (March 1996, STS 76 to October 1997, STS 86). A solar panel array with more than 10 years space exposure was removed from the MIR core module in November 1997, and returned to Earth in January, 1998, STS 89. MEEP and the returned solar array are part of the International Space Station (ISS) Risk Mitigation Program. This space flight hardware has been inspected and studied by teams of space environmental effects (SEE) investigators for micrometeoroid and space debris effects, space exposure effects on materials, and electrical performance. This paper reports changes in cleanliness of parts of MEEP and the solar array due to the space exposures. Special attention is given to the extensive water soluble residues deposited on some of the flight hardware surfaces. Directionality of deposition and chemistry of these residues are discussed.
Author
Solar Arrays; Panels; Aerospace Environments; Mir Space Station; Payloads; Spacecraft Maintenance

20040090471 NASA, Washington, DC, USA
Full Service
Morring, Frank, Jr.; Aviation Week and Space Technology; August 16, 2004; ISSN 0005-2175; Volume 161, No. 7, pp. 32-33; In English; Copyright; Avail: Other Sources

NASA is moving ahead with the sole-source procurement of a Canadian robot to service the Hubble Space Telescope, gaining confidence the International Space Station (ISS) technology can perform all of the tasks shuttle-launched astronauts were scheduled to do before the Columbia accident changed everything. The U.S. agency is negotiating with MD Robotics, a MacDonald Dettwiler unit located in Brampton, Ontario, for a version of the Special Purpose Dexterous Manipulator (SPDM) the company developed for the ISS. The SPDM would be the business end of a throwaway module designed to

replace batteries and gyroscopes, pull old instruments and install new ones before plunging to a targeted reentry over the Pacific.
Author
Hubble Space Telescope; Spacecraft Maintenance; Space Maintenance; Robot Arms

13 ASTRODYNAMICS

Includes powered and free flight trajectories; orbital and launching dynamics.

20040087240 NASA Langley Research Center, Hampton, VA, USA
Oscillatory Trajectories Applied to NASA's DF-7 Configuration
Moster, Gregory E.; Martin, John G.; [1999]; 11 pp.; In English; AIAA 9th International Space Planes and Hypersonic Systems and Technologies Conference, 1-5 Nov. 1999, Norfolk, VA, USA
Report No.(s): AIAA Paper 99-4931; Copyright; Avail: CASI; A03, Hardcopy

Analyses of oscillating trajectories were performed using the extensively analyzed NASA Dual Fuel Study Vehicle DF-7 that was designed for Mach 10 global reach reconnaissance/strike missions. (This vehicle was later modified to provide a vehicle design capable of both long-range hypersonic cruise and trajectory pull-up for launching an upper stage to deliver payload to orbit.) Study results indicate that oscillating trajectories result in reduced range, high g loading, higher peak heating, and more severe thermal gradients compared to steady-state cruise. These disadvantages plus the operational complexity of turning the engine off and on during each cycle, contribute to making oscillating trajectories undesirable for lifting-body configurations optimized for hypersonic cruise. Additionally, this study shows that technological advances would most likely benefit steady-state cruise trajectories greater than the oscillatory trajectories.
Author
Boostglide Vehicles; Trajectory Analysis; Oscillations; Hypersonic Gliders

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and test chambers and simulators. Also includes extraterrestrial bases and supporting equipment. For related information see also *09 Research and Support Facilities (Air)*.

20040086757 NASA Ames Research Center, Moffett Field, CA, USA
Applications of Intelligent Tutoring Systems to Human-Robotic Exploration of Mars
Clancey, William J.; June 1, 2004; 1 pp.; In English; Intelligent Tutoring Systems Conference, 30 Aug. - 3 Sep. 2004, Maceio, Brazil; No Copyright; Avail: Other Sources; Abstract Only

Space missions with small crews extending over several years with time-delay preventing normal conversations with people on earth will raise many challenges for training. Of special interest are possible three-year missions to Mars, requiring refresher instruction and learning new skills based on unexpected problems with machines and environmental conditions. For example, the crew will be required to monitor and repair more complex life support systems for air and water recycling than we even know how to build today. Highly educated astronauts, often with several doctorate degrees, require a very different mode of interaction than we have developed for school children or even typical college students. Explanation methods may need to differ-using analogies and techniques from different domains-depending on whether the astronaut is an astrophysicist, a pilot, or a geologist.Virtual reality (e.g., for Hubble repair missions) and 'integrated' simulations (involving role-playing and emphasizing failure scenarios) are the most common advanced forms of instruction used in space flight today. The emphasis is on collaborative, embodied interaction with the same workstations and tools used in practice (e.g., a cockpit simulator). Otherwise, computerized instructional technology used by NASA is not model-based or tutorial in nature. This discussion will review some of the key instructional methods used at NASA over the past two decades and consider why ITS methods have not been exploited. Some of the problems and opportunities for training for Mars missions are examined, including how using robots in exploration activities will help but raise new training problems. These ideas will be illustrated with examples from the BrahmsVE system in which a browser- based virtual reality display with avatars allows interacting with a distributed multiagent system, in which agents can be people, robots, or software programs. Using BrahmsVE may provide a way for

astronauts to interact with proxies of people who serve as instructional coaches on Mars.
Author
Astronauts; Mars Missions; Education

20040090517 NASA Langley Research Center, Hampton, VA, USA
Flight-Simulated Launch-Pad-Abort-to-Landing Maneuvers for a Lifting Body
Jackson, E. Bruce; Rivers, Robert A.; [1998]; 8 pp.; In English; Atmospheric Flight Mechanics Conference, 10-12 Aug. 1998, Boston, MA, USA
Report No.(s): AIAA Paper 98-4254; Copyright; Avail: CASI

The results of an in-flight investigation of the feasibility of conducting a successful landing following a launch-pad abort of a vertically-launched lifting body are presented. The study attempted to duplicate the abort-to-land-ing trajectory from the point of apogee through final flare and included the steep glide and a required high-speed, low-altitude turn to the runway heading. The steep glide was flown by reference to ground-provided guidance. The low-altitude turn was flown visually with a reduced field- of-view duplicating that of the simulated lifting body. Results from the in-flight experiment are shown to agree with ground-based simulation results; however, these tests should not be regarded as a definitive due to performance and control law dissimilarities between the two vehicles.
Author
Lifting Bodies; Launching Pads; In-Flight Simulation; Maneuvers; Reentry Vehicles; Abort Trajectories; Aircraft Landing

20040095302 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Instrument Synthesis and Analysis Laboratory
Wood, H. John; January 2004; 11 pp.; In English; Frontiers in Optics 2004, 12-13 Oct. 2004, Rochester, NY, USA; No Copyright; Avail: CASI; A03, Hardcopy

The topics addressed in this viewgraph presentation include information on 1) Historic instruments at Goddard; 2) Integrated Design Capability at Goddard; 3) The Instrument Synthesis and Analysis Laboratory (ISAL).
CASI
Laboratories; Instruments; Product Development

15
LAUNCH VEHICLES AND LAUNCH OPERATIONS

Includes all classes of launch vehicles, launch/space vehicle systems, and boosters; and launch operations. For related information see also *18 Spacecraft Design, Testing and Performance*; and *20 Spacecraft Propulsion and Power*.

20040086107 Paul Scherrer Inst., Villigen
Polymers Used as Fuel for Laser Plasma Thrusters in Small Satellites
Lippert, Thomas; Apr. 30, 2003; 50 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F61775-02-W-E038
Report No.(s): AD-A424397; EOARD-SPC-02-4038; No Copyright; Avail: CASI; A03, Hardcopy

This report results from a contract tasking Paul Scherrer Institut as follows: The contractor will investigate those properties of promising polymers which influence the performance of Laser Plasma Thrusters LPTs). Preliminary data show that the properties of the ablated polymer have a strong effect on the achievable specific impulse. Among the issues to be investigated are choice of substrate and adhesion of the polymer to the substrate influence of dopants to increase optical absorption and thickness of the polymer layer.
DTIC
Artificial Satellites; Laser Plasmas; Plasma Engines; Propulsion

20040086197 Air War Coll., Maxwell AFB, AL
Going Deep: A System Concept for Detecting Deeply Buried Facilities From Space
Streland, Arnold H.; Feb. 23, 2003; 69 pp.; In English
Report No.(s): AD-A424602; No Copyright; Avail: CASI; A04, Hardcopy

Finding deeply buried facilities stands out as one of the toughest technical challenges in the Air Force's efforts to find, fix, target, track, engage and assess targets of interest anywhere on earth. Nations have located potential high-value, high-interest targets such as weapons of mass destruction (WMD), WMD manufacturing plants and storage areas, missile

garrisons, fuel storage areas and command and control nodes underground. This paper will focus on the development and application of gravity field sensors for deeply buried target detection. It will begin with an explanation of what deeply buried facilities are and how their construction and use has evolved over the years. Next, the discussion will look at the weapons available today to counter deeply buried facilities and the intelligence information needed to make these weapons effective. The information needed to properly target these weapons will directly influence the capability of the sensors needed to detect and characterize deeply buried facilities. The focus of the paper will then shift to intelligence sources, starting with the intelligence capabilities available today and the ability of a potential enemy to counter those intelligence assets, then shift to exploring intelligence sources not in use today and their potential application in the hunt for deeply buried facilities. Finally, this paper will investigate gravity measurement technology to address the problem of deeply buried facility detection and characterization. The examination will include the history of gravity measurement technology, current uses for geology and earth science, ongoing laboratory developments and the applicability of this technology to the search of deeply buried targets. The discussion will conclude with desired system capabilities and potential system concepts.
DTIC
Detection; Target Acquisition

20040087109 NASA Langley Research Center, Hampton, VA, USA
X-33 Aerodynamic and Aeroheating Computations for Wind Tunnel and Flight Conditions
Hollis, Brian R.; Thompson, Richard A.; Murphy, Kelly J.; Nowak, Robert J.; Riley, Christopher J.; Wood, William A.; Alter, Stephen J.; Prabhu, Ramadas K.; [1999]; 17 pp.; In English; AIAA Atmospheric Flight Mechanics Conference, 9-11 Aug. 1999, Portland, OR, USA
Report No.(s): AIAA Paper 99-4163; Copyright; Avail: CASI; A03, Hardcopy

This report provides an overview of hypersonic Computational Fluid Dynamics research conducted at the NASA Langley Research Center to support the Phase II development of the X-33 vehicle. The X-33, which is being developed by Lockheed-Martin in partnership with NASA, is an experimental Single-Stage-to-Orbit demonstrator that is intended to validate critical technologies for a full-scale Reusable Launch Vehicle. As part of the development of the X-33, CFD codes have been used to predict the aerodynamic and aeroheating characteristics of the vehicle. Laminar and turbulent predictions were generated for the X 33 vehicle using two finite- volume, Navier-Stokes solvers. Inviscid solutions were also generated with an Euler code. Computations were performed for Mach numbers of 4.0 to 10.0 at angles-of-attack from 10 deg to 48 deg with body flap deflections of 0, 10 and 20 deg. Comparisons between predictions and wind tunnel aerodynamic and aeroheating data are presented in this paper. Aeroheating and aerodynamic predictions for flight conditions are also presented.
Author
Aerodynamic Characteristics; Aerodynamic Heating; Computational Fluid Dynamics; Flight Conditions

20040087250 NASA Langley Research Center, Hampton, VA, USA
An Airbreathing Launch Vehicle Design with Turbine-Based Low-Speed Propulsion and Dual Mode Scramjet High-Speed Propulsion
Moses, P. L.; Bouchard, K. A.; Vause, R. F.; Pinckney, S. Z.; Ferlemann, S. M.; Leonard, C. P.; Taylor, L. W., III; Robinson, J. S.; Martin, J. G.; Petley, D. H., et al.; [1999]; 22 pp.; In English; 9th International Space Planes and Hypersonic Systems and Technologies Conference, 1-5 Nov. 1999, Norfolk, VA, USA
Report No.(s): AIAA Paper 99-4948; Copyright; Avail: CASI; A03, Hardcopy

Airbreathing launch vehicles continue to be a subject of great interest in the space access community. In particular, horizontal takeoff and horizontal landing vehicles are attractive with their airplane-like benefits and flexibility for future space launch requirements. The most promising of these concepts involve airframe integrated propulsion systems, in which the external undersurface of the vehicle forms part of the propulsion flowpath. Combining of airframe and engine functions in this manner involves all of the design disciplines interacting at once. Design and optimization of these configurations is a most difficult activity, requiring a multi-discipline process to analytically resolve the numerous interactions among the design variables. This paper describes the design and optimization of one configuration in this vehicle class, a lifting body with turbine-based low-speed propulsion. The integration of propulsion and airframe, both from an aero-propulsive and mechanical perspective are addressed. This paper primarily focuses on the design details of the preferred configuration and the analyses performed to assess its performance. The integration of both low-speed and high-speed propulsion is covered. Structural and mechanical designs are described along with materials and technologies used. Propellant and systems packaging are shown and the mission-sized vehicle weights are disclosed.
Author
Air Breathing Engines; Launch Vehicle Configurations; Propulsion System Configurations; Hybrid Propulsion; Spacecraft Design; Design Optimization

16
SPACE TRANSPORTATION AND SAFETY

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques. For related information see also *03 Air Transportation and Safety; 15 Launch Vehicles and Launch Operations*; and *18 Spacecraft Design, Testing and Performance*. For space suits see *54 Man/System Technology and Life Support*.

20040086578 NASA Langley Research Center, Hampton, VA, USA
Anomaly Analysis: NASA's Engineering and Safety Center Checks Recurring Shuttle Glitches
Morring, Frank, Jr.; Aviation Week and Space Technology; August 02, 2004; ISSN 0005-2175; Volume 161, No. 5, pp. 53; In English; Copyright; Avail: Other Sources

The NASA Engineering and Safety Center (NESC), set up in the wake of the Columbia accident to backstop engineers in the space shuttle program, is reviewing hundreds of recurring anomalies that the program had determined don't affect flight safety to see if in fact they might. The NESC is expanding its support to other programs across the agency, as well. The effort, which will later extend to the International Space Station (ISS), is a principal part of the attempt to overcome the normalization of deviance--a situation in which organizations proceeded as if nothing was wrong in the face of evidence that something was wrong--cited by sociologist Diane Vaughn as contributing to both space shuttle disasters.
Author
Anomalies; Disasters; Flight Safety; Space Shuttles

20040086727 NASA Glenn Research Center, Cleveland, OH, USA
GRC Payload Hazard Assessment: Supporting the STS-107 Accident Investigation
Schoren, William R.; Zampino, Edward J.; July 2004; 38 pp.; In English
Contract(s)/Grant(s): WBS 22-101-46-01; WBS 22-400-31-30-01
Report No.(s): NASA/TM-2004-213050; E-14486; No Copyright; Avail: CASI; A03, Hardcopy

A hazard assessment was conducted on the GRC managed payloads in support of a NASA Headquarters Code Q request to examine STS-107 payloads and determine if they were credible contributors to the Columbia accident. This assessment utilized each payload's Final Flight Safety Data Package for hazard identification. An applicability assessment was performed and most of the hazards were eliminated because they dealt with payload operations or crew interactions. A Fault Tree was developed for all the hazards deemed applicable and the safety verification documentation was reviewed for these applicable hazards. At the completion of this hazard assessment, it was concluded that none of the GRC managed payloads were credible contributors to the Columbia accident.
Author
Space Transportation System Flights; Accident Investigation; Space Shuttle Payloads; Hazards

17
SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes space systems telemetry; space communications networks; astronavigation and guidance; and spacecraft radio blackout. For related information see also *04 Aircraft Communications and Navigation*; and *32 Communications and Radar*.

20040095329 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Adaptive Optics Communications Performance Analysis
Srinivasan, M.; Vilnrotter, V.; Troy, M.; Wilson, K.; Interplanetary Network Progress Report; August 15, 2004; Volume 41-158; 14 pp.; In English
Report No.(s): IPN-PR-42-158; No Copyright; Avail: CASI; A03, Hardcopy

The performance improvement obtained through the use of adaptive optics for deep-space communications in the presence of atmospheric turbulence is analyzed. Using simulated focal-plane signal-intensity distributions, uncoded pulse-position modulation (PPM) bit-error probabilities are calculated assuming the use of an adaptive focal-plane detector array as well as an adaptively sized single detector. It is demonstrated that current practical adaptive optics systems can yield performance gains over an uncompensated system ranging from approximately 1 dB to 6 dB depending upon the PPM order and background radiation level.
Author
Adaptive Optics; Deep Space; Reliability Analysis; Space Communication

18
SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and spacecraft control and stability characteristics. For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance; 39 Structural Mechanics*; and *16 Space Transportation and Safety*.

20040086747 NASA Langley Research Center, Hampton, VA, USA
The International Space Station Evolution Data Book: An Overview and Status
Antol, Jeffrey; Jorgensen, Catherine A.; [1999]; 6 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

The evolution and enhancement of the International Space Station (ISS) is currently being planned in conjunction with the on-orbit construction of the baseline configuration. Three principal areas have been identified that will contribute to the evolution of ISS: Pre-Planned Program Improvement (P3I), Utilization & Commercialization, and Human Exploration and Development of Space (HEDS) missions. The ISS Evolution Strategy, under development by the Spacecraft and Sensors Branch of NASA Langley Research Center, seeks to coordinate the P3I technology development with Commercialization/ Utilization activities and HEDS advanced mission accommodation to provide synergistic technology developments for all three areas. The focal point of this proposed strategy is the ISS Evolution Data Book (EDB), a tool for aiding the evolution and enhancement of ISS beyond Assembly Complete. This paper will discuss the strategy and provide an overview of the EDB, describing the contents of each section. It will also discuss potential applications of the EDB and present an example Design Reference Mission (DRM). The latest status of the EDB and the plans for completing and enhancing the book will also be summarized.
Author
International Space Station; Space Station Payloads; Space Commercialization; Utilization

20040086749 NASA Langley Research Center, Hampton, VA, USA
Subsonic and Transonic Dynamic Stability Characteristics of the X-33
Tomek, D.; Boyden, R.; [2000]; 19 pp.; In English; 38th Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2000, Reno, NV, USA
Report No.(s): AIAA Paper 2000-0266; Copyright; Avail: CASI; A03, Hardcopy

Dynamic stability testing was conducted on a 2.5% scale model of the X-33 technology demonstrator sub-orbital flight-test vehicle. This testing was conducted at the NASA Langley Research Center (LaRC) l6-Foot Transonic Wind Tunnel with the LaRC High-speed Dynamic Stability system. Forced oscillation data were acquired for various configurations over a Mach number range of 0.3 to 1.15 measuring pitch, roll and yaw damping, as well as the normal force due to pitch rate and the cross derivatives. The test angle of attack range was from -2 to 24 degrees, except for those cases where load constraints limited the higher angles of attack at the higher Mach numbers. A variety of model configurations with and without control surfaces were employed, including a body alone configuration. Stable pitch damping is exhibited for the baseline configuration throughout the angle of attack range for Mach numbers 0.3, 0.8, and 1.15. Stable pitch damping is present for Mach numbers 0.9 and 0.6 with the exception of angles 2 and 16 degrees, respectively. Constant and stable roll damping were present for the baseline configuration over the range of Mach numbers up to an angle of attack of 16 degrees. The yaw damping for the baseline is somewhat stable and constant for the angle of attack range from -2 to 8 degrees, with the exception of Mach numbers 0.6 and 0.8. Yaw damping becomes highly unstable for all Mach numbers at angles of attack greater than 8 degrees.
Author
Angle of Attack; Control Surfaces; Dynamic Stability; Flight Test Vehicles; Mach Number; Stability Tests; Subsonic Speed; Transonic Speed; Wind Tunnel Tests

20040086750 NASA Langley Research Center, Hampton, VA, USA
International Space Station Attitude Motion Associated With Flywheel Energy Storage
Roithmayr, Carlos M.; [1999]; 6 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

Flywheels can exert torque that alters the Station's attitude motion, either intentionally or unintentionally. A design is presented for a once planned experiment to contribute torque for Station attitude control, while storing or discharging energy. Two contingencies are studied: the abrupt stop of one rotor while another rotor continues to spin at high speed, and energy

storage performed with one rotor instead of a counter rotating pair. Finally, the possible advantages to attitude control offered by a system of ninety-six flywheels are discussed.
Author
Flywheels; International Space Station; Attitude (Inclination); Attitude Control; Computerized Simulation; Spacecraft Motion

20040086762 NASA Langley Research Center, Hampton, VA, USA
Aerothermal Test of Thermal Protection Systems for X-33 Reusable Launch Vehicle
Sawyer, James Wayne; Hodge, Jefferson; Moore, Brad; Snyder, Kevin; [1999]; 11 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

An array of metallic Thermal Protection System (TPS) panels developed for the windward surface of the X-33 vehicle was tested in the 8-Foot High Temperature Tunnel at the NASA Langley Research Center. These tests were the first aerothermal tests of an X-33 TPS array and the test results will be used to validate the TPS for the X-33 flight program. Specifically, the tests evaluated the structural and thermal performance of the TPS, the effectiveness of the high temperature seals between adjacent panels and the durability of the TPS under realistic aerothermal flight conditions. The effect of varying panel-to-panel step heights, intentional damage to the seals between adjacent panels, and the use of secondary seals were also investigated during the test program. The metallic TPS developed for the windward surface of the X-33, the blanket TPS developed to protect the leeward surfaces of the X-33, and the test program in the 8-Foot High Temperature Tunnel are presented and discussed.
Author
Aerothermodynamics; Thermal Protection; Surface Vehicles; Damage

20040086798 NASA Langley Research Center, Hampton, VA, USA
Analysis and Testing of High Temperature Fibrous Insulation for Reusable Launch Vehicles
Daryabeigi, Kamran; [1999]; 11 pp.; In English; 37th AIAA Aerospace Sciences Meeting and Exhibit, 11-14 Jan. 1999, Reno, NV, USA
Report No.(s): AIAA-99-1044; Copyright; Avail: CASI; A03, Hardcopy

Analytical models were developed to model the heat transfer through high-temperature fibrous insulation used in metallic thermal protection systems on reusable launch vehicles. The optically thick approximation was used to simulate radiation heat transfer through the insulation. Different models for gaseous conduction and solid conduction in the fibers, and for combining the various modes of heat transfer into a local, volume-averaged, thermal conductivity were considered. The governing heat transfer equations were solved numerically, and effective thermal conductivities were calculated from the steady-state results. An experimental apparatus was developed to measure the apparent thermal conductivity of insulation subjected to pressures, temperatures and temperature gradients representative of re-entry conditions for launch vehicles. The apparent thermal conductivity of an alumina fiber insulation was measured at nominal densities of 24, 48 and 96 kg/cu m. Data were obtained at environmental pressures from 10(exp 4) to 760 torr, with the insulation cold side maintained at room temperature and its hot side temperature varying up to 1000 C. The experimental results were used to evaluate the analytical models. The best analytical model resulted in effective thermal conductivity predictions that were within 8% of experimental results.
Author
Reusable Launch Vehicles; Thermal Insulation; Thermal Conductivity; Thermal Protection; Heat Transfer; Radiative Heat Transfer

20040086813 NASA Langley Research Center, Hampton, VA, USA
Conformal Cryogenic Tank Trade Study for Reusable Launch Vehicles
Rivers, H. Kevin; [1999]; 13 pp.; In English; Space Technology and Application International Forum, 1999, Albuquerque, NM, USA; No Copyright; Avail: CASI; A03, Hardcopy

Future reusable launch vehicles may be lifting bodies with non-circular cross section like the proposed Lockheed-Martin VentureStar(tm). Current designs for the cryogenic tanks of these vehicles are dual-lobed and quad-lobed tanks which are packaged more efficiently than circular tanks, but still have low packaging efficiencies with large gaps existing between the vehicle outer mold line and the outer surfaces of the tanks. In this study, tanks that conform to the outer mold line of a non-circular vehicle were investigated. Four structural concepts for conformal cryogenic tanks and a quad-lobed tank concept were optimized for minimum weight designs. The conformal tank concepts included a sandwich tank stiffened with axial tension webs, a sandwich tank stiffened with transverse tension webs, a sandwich tank stiffened with rings and tension ties, and a sandwich tank stiffened with orthogrid stiffeners and tension ties. For each concept, geometric parameters (such as ring

frame spacing, the number and spacing of tension ties or webs, and tank corner radius) and internal pressure loads were varied and the structure was optimized using a finite-element-based optimization procedure. Theoretical volumetric weights were calculated by dividing the weight of the barrel section of the tank concept and its associated frames, webs and tension ties by the volume it circumscribes. This paper describes the four conformal tank concepts and the design assumptions utilized in their optimization. The conformal tank optimization results included theoretical weights, trends and comparisons between the concepts, are also presented, along with results from the optimization of a quad-lobed tank. Also, the effects of minimum gauge values and non-optimum weights on the weight of the optimized structure are described in this paper.
Author
Reusable Launch Vehicles; Cryogenics; Tanks (Containers); Structural Design; Lifting Bodies

20040086861 NASA Langley Research Center, Hampton, VA, USA
X-33 Computational Aeroheating Predictions and Comparisons with Experimental Data
Hollis, Brian R.; Horvath, Thomas J.; Berry, Scott A.; Hamilton, H. Harris, II; Alter, Stephen J.; [1999]; 16 pp.; In English; 33rd AIAA Thermophysics Conference, 28 Jun. - 1 Jul. 1999, Norfolk, VA, USA
Report No.(s): AIAA Paper 99-3559; Copyright; Avail: CASI; A03, Hardcopy

The goal of the NASA Reusable Launch Vehicle (RLV) technology program is to develop and demonstrate essential, cost-effective technologies for next-generation launch systems. The X 33 flight vehicle presently being developed by Lockheed-Martin is an experimental Single- Stage-to-Orbit (SSTO) demonstrator that is intended to validate critical technologies for the full- scale RLV. One of the key technologies to be demonstrated on the X 33 vehicle is an advanced, metallic thermal protection system (TPS). As part of the development of this TPS system, the aeroheating environment of the X-33 is being defined through conceptual analysis, ground-based wind-tunnel testing and computational fluid dynamics (CFD). This report provides an overview of the hypersonic aeroheating CFD research conducted at the NASA Langley Research Center (LaRC) in support of this TPS development activity. In this research, laminar and turbulent aeroheating predictions were generated at wind-tunnel test conditions for the X 33 vehicle using both a finite-volume, Navier-Stokes solver, and a coupled inviscid-solver/boundary-layer-code engineering method. Computations were performed for angles-of-attack of 20 deg., 30 deg., and 40 deg. Comparisons between the predictions and wind tunnel data for the centerline and axial heating distributions were generally within 10% for the Navier-Stokes method and 25% for the engineering code method. Aeroheating distributions were also computed for the peak heating point on the flight trajectory.
Author
Aerodynamic Heating; Computational Fluid Dynamics; Data Acquisition; X-33 Reusable Launch Vehicle; Cost Effectiveness; Ground Tests

20040086895 AI Signal Research, Inc., Huntsville, AL, USA
Perspectives on Space Transportation Innovative Design
Blair, James; Ryan, Robert; Shutzenhofer, Luke; Innovative Design of Complex Engineering Systems; July 2004, pp. 101-124; In English; See also 20040086893; No Copyright; Avail: CASI; A03, Hardcopy

This presentation provides perspectives on innovative design of Space Transportation Systems. The authors are retired NASA engineers/managers, who are employed by AI Signal Research, Inc. in support of NASA/MSFC Employee and Organizational Development Division, providing knowledge transfer to less experienced personnel. A primary focus has been the engineering design process, its characterization, teaching, and improvement.
Author
Space Transportation System; Spacecraft Design; Engineering Management

20040086952 NASA Langley Research Center, Hampton, VA, USA
A Radiation Shielding Code for Spacecraft and Its Validation
Shinn, J. L.; Cucinotta, F. A.; Singleterry, R. C.; Wilson, J. W.; Badavi, F. F.; Badhwar, G. D.; Miller, J.; Zeitlin, C.; Heilbronn, L.; Tripathi, R. K., et al.; [2000]; 15 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

The HZETRN code, which uses a deterministic approach pioneered at NASA Langley Research Center, has been developed over the past decade to evaluate the local radiation fields within sensitive materials (electronic devices and human tissue) on spacecraft in the space environment. The code describes the interactions of shield materials with the incident galactic cosmic rays, trapped protons, or energetic protons from solar particle events in free space and low Earth orbit. The content of incident radiations is modified by atomic and nuclear reactions with the spacecraft and radiation shield materials. High-energy heavy ions are fragmented into less massive reaction products, and reaction products are produced by direct

knockout of shield constituents or from de-excitation products. An overview of the computational procedures and database which describe these interactions is given. Validation of the code with recent Monte Carlo benchmarks, and laboratory and flight measurement is also included.
Author
Spacecraft Design; Radiation Shielding; Computation; Spacecraft Environments

20040087096 NASA Langley Research Center, Hampton, VA, USA
Aerospace Systems Design in NASA's Collaborative Engineering Environment
Monell, Donald W.; Piland, William M.; [1999]; 11 pp.; In English; 50th International Astronautical Congress, 4-8 Oct. 1999, Amsterdam, Netherlands
Report No.(s): IAF-99.U.1.01; Copyright; Avail: CASI; A03, Hardcopy

Past designs of complex aerospace systems involved an environment consisting of collocated design teams with project managers, technical discipline experts, and other experts (e.g. manufacturing and systems operations). These experts were generally qualified only on the basis of past design experience and typically had access to a limited set of integrated analysis tools. These environments provided less than desirable design fidelity, often lead to the inability of assessing critical programmatic and technical issues (e.g., cost risk, technical impacts), and generally derived a design that was not necessarily optimized across the entire system. The continually changing, modern aerospace industry demands systems design processes that involve the best talent available (no matter where it resides) and access to the best design and analysis tools. A solution to these demands involves a design environment referred to as collaborative engineering. The collaborative engineering environment evolving within the National Aeronautics and Space Administration (NASA) is a capability that enables the Agency's engineering infrastructure to interact and use the best state-of-the-art tools and data across organizational boundaries. Using collaborative engineering, the collocated team is replaced with an interactive team structure where the team members are geographically distributed and the best engineering talent can be applied to the design effort regardless of physical location. In addition, a more efficient, higher quality design product is delivered by bringing together the best engineering talent with more up-to-date design and analysis tools. These tools are focused on interactive, multidisciplinary design and analysis with emphasis on the complete life cycle of the system, and they include nontraditional, integrated tools for life cycle cost estimation and risk assessment. NASA has made substantial progress during the last two years in developing a collaborative engineering environment. NASA is planning to use this collaborative engineering infrastructure to provide better aerospace systems life cycle design and analysis, which includes analytical assessment of the technical and programmatic aspects of a system from 'cradle to grave.' This paper describes the recent NASA developments in the area of collaborative engineering, the benefits (realized and anticipated) of using the developed capability, and the long-term plans for implementing this capability across the Agency.
Author
Aerospace Industry; Systems Engineering; Design Analysis; Aerospace Systems; Systems Analysis; Aerospace Engineering

20040087142 NASA Glenn Research Center, Cleveland, OH, USA
Low Earth Orbital Atomic Oxygen Interactions With Materials
Banks, Bruce A.; Miller, Sharon K.; deGroh, Kim K.; August 2004; 26 pp.; In English; Second International Energy Conversion Engineering Conference, 16-19 Aug. 2004, Providence, RI, USA
Contract(s)/Grant(s): WBS 319-20-E1
Report No.(s): NASA/TM-2004-213223; AIAA Paper 2004-5638; E-14730; No Copyright; Avail: CASI; A03, Hardcopy

Atomic oxygen is formed in the low Earth orbital environment (LEO) by photo dissociation of diatomic oxygen by short wavelength (\h 243 nm) solar radiation which has sufficient energy to break the 5.12 eV O2 diatomic bond in an environment where the mean free path is sufficiently long (~ 108 meters) that the probability of reassociation or the formation of ozone (O3) is small. As a consequence, between the altitudes of 180 and 650 km, atomic oxygen is the most abundant species. Spacecraft impact the atomic oxygen resident in LEO with sufficient energy to break hydrocarbon polymer bonds, causing oxidation and thinning of the polymers due to loss of volatile oxidation products. Mitigation techniques, such as the development of materials with improved durability to atomic oxygen attack, as well as atomic oxygen protective coatings, have been employed with varying degrees of success to improve durability of polymers in the LEO environment. Atomic oxygen can also oxidize silicones and silicone contamination to produce non-volatile silica deposits. Such contaminants are present on most LEO missions and can be a threat to performance of optical surfaces. The LEO atomic oxygen environment, its interactions with materials, results of space testing, computational modeling, mitigation techniques, and ground laboratory simulation procedures and issues are presented.
Author
Durability; Low Earth Orbits; Oxygen Atoms; Diatomic Molecules; Earth Orbital Environments; Gas Dissociation

20040087159 NASA Langley Research Center, Hampton, VA, USA

Progress in Air Separation with the Vortex Tube

Balepin, V.; Rosolt, D.; Petley, D.; [1999]; 6 pp.; In English; 9th International Space Planes and Hypersonic Systems and Technologies Conference, 1-4 Nov. 1999, Norfolk, VA, USA

Report No.(s): AIAA Paper 99-4844; Copyright; Avail: CASI; A02, Hardcopy

The current study is characterized by two distinct phases in the development of the vortex tube (VT) technology as a primary means for in-flight air separation. The purpose of the first phase was to systematically identify parameters that influence oxygen concentration and recovery and to quantify the extent of that influence. To that end, the project team used a series of planned factorial experiments to identify statistically significant variables (factors) and their interactions. These experiments identified a best range of the operating envelope that includes nozzle diameter, orifice diameter, inlet air pressure, and liquid phase content in the inlet air. The best results observed in this envelope were an oxygen content of approximately 68% and a recovery factor of approximately 38%. The primary objectives of the second phase of the current study were to investigate the application effects of the two different air separation efficiency enhancement methods. One of these methods resulted in a concentration increase of 12% and second resulted in a concentration increase of 5%. Several aspects of these methods application are subject to optimize.

Author

Factorial Design; Hilsch Tubes; Vortices; Oxygen; Concentration (Composition)

20040087392 NASA Langley Research Center, Hampton, VA, USA

X-34 Vehicle Aerodynamic Characteristics

Brauckmann, Gregory J.; [1998]; 14 pp.; In English

Report No.(s): AIAA Paper 98-2531; Copyright; Avail: CASI; A03, Hardcopy

The X-34, being designed and built by the Orbital Sciences Corporation, is an unmanned sub-orbital vehicle designed to be used as a flying test bed to demonstrate key vehicle and operational technologies applicable to future reusable launch vehicles. The X-34 will be air-launched from an L-1011 carrier aircraft at approximately Mach 0.7 and 38,000 feet altitude, where an onboard engine will accelerate the vehicle to speeds above Mach 7 and altitudes to 250,000 feet. An unpowered entry will follow, including an autonomous landing. The X-34 will demonstrate the ability to fly through inclement weather, land horizontally at a designated site, and have a rapid turn-around capability. A series of wind tunnel tests on scaled models was conducted in four facilities at the NASA Langley Research Center to determine the aerodynamic characteristics of the X-34. Analysis of these test results revealed that longitudinal trim could be achieved throughout the design trajectory. The maximum elevon deflection required to trim was only half of that available, leaving a margin for gust alleviation and aerodynamic coefficient uncertainty. Directional control can be achieved aerodynamically except at combined high Mach numbers and high angles of attack, where reaction control jets must be used. The X-34 landing speed, between 184 and 206 knots, is within the capabilities of the gear and tires, and the vehicle has sufficient rudder authority to control the required 30-knot crosswind.

Author

X-34 Reusable Launch Vehicle; Aerodynamic Characteristics; Test Stands; Hypersonic Speed

20040090463 NASA Langley Research Center, Hampton, VA, USA

Prediction and Validation of Mars Pathfinder Hypersonic Aerodynamic Data Base

Gnoffo, Peter A.; Braun, Robert D.; Weilmuenster, K. James; Mitcheltree, Robert A.; Engelund, Walter C.; Powell, Richard W.; [1998]; 11 pp.; In English; 7th AIAA/ASME Joint Thermophysics and Heat Transfer Conference, 15-18 Jun. 1998, Albuquerque, NM, USA

Report No.(s): AIAA Paper98-2445; Copyright; Avail: CASI; A03, Hardcopy

Postflight analysis of the Mars Pathfinder hypersonic, continuum aerodynamic data base is presented. Measured data include accelerations along the body axis and axis normal directions. Comparisons of preflight simulation and measurements show good agreement. The prediction of two static instabilities associated with movement of the sonic line from the shoulder to the nose and back was confirmed by measured normal accelerations. Reconstruction of atmospheric density during entry has an uncertainty directly proportional to the uncertainty in the predicted axial coefficient. The sensitivity of the moment coefficient to freestream density, kinetic models and center-of-gravity location are examined to provide additional consistency checks of the simulation with flight data. The atmospheric density as derived from axial coefficient and measured axial accelerations falls within the range required for sonic line shift and static stability transition as independently determined from normal accelerations.

Author

Mars Pathfinder; Aerodynamics; Hypersonics; Data Bases; Acceleration Measurement; Postflight Analysis

20040090506 NASA Langley Research Center, Hampton, VA, USA

Mars Ascent Vehicle Flight Analysis

Desai, P. N.; Braun, R. D.; Engelund, W. C.; Cheatwood, F. M.; Kangas, J. A.; [1998]; 11 pp.; In English; 7th AIAA/ASME Joint Thermophysics and Heat Transfer Conference, 15-18 Jun. 1998, Albuquerque, NM, USA

Report No.(s): AIAA Paper 98-2850; Copyright; Avail: CASI; A03, Hardcopy

The scientific objective of the Mars Surveyor Program 2005 mission is to return Mars rock, soil, and atmospheric samples to Earth for detailed analysis. The present investigation focuses on design of Mars Ascent Vehicle for this mission. Aerodynamic, aerothermodynamic, and trajectory design considerations are addressed to assess the ascent configuration, determine aerodynamic stability, characterize thermal protection system requirements, and ascertain the required system mass. Aerodynamic analysis reveals a subsonic static instability with the baseline configuration; however, stability augmentation options are proposed to mitigate this problem. The ascent aerothermodynamic environment is shown to be benign (on the order of the sea-level boiling point of water on Earth). As a result of these low thermal and pressure loads, a lightweight, low rigidity material can be employed as the aftbody aerodynamic shroud. The required nominal MAV lift-off mass is 426 kg for a December 2006 equatorial launch into a 300-km circular orbit with 30-degree inclination. Off-nominal aerodynamic and atmospheric conditions are shown to increase this liftoff mass by approximately 10%. Through performance of these analyses, the Mars Ascent Vehicle is deemed feasible with respect to the current mission mass and size constraints.

Author

Mission Planning; Planetary Geology; Rocks; Samples; Soil Sampling; Aerodynamic Characteristics; Mars Surface

20040090507 NASA Langley Research Center, Hampton, VA, USA

A Passive Earth-Entry Capsule for Mars Sample Return

Mitcheltree, R. A.; Kellas, S.; Dorsey, J. T.; Desai, P. N.; Martin, C. J.; [1998]; 14 pp.; In English; 7th AIAA/ASME Joint Thermophysics and Heat Transfer Conference, 15-18 Jun. 1998, Albuquerque, NM, USA

Report No.(s): AIAA Paper 98-2851; Copyright; Avail: CASI; A03, Hardcopy

A combination of aerodynamic analysis and testing, aerothermodynamic analysis, structural analysis and testing, impact analysis and testing, thermal analysis, ground characterization tests, configuration packaging, and trajectory simulation are employed to determine the feasibility of an entirely passive Earth entry capsule for the Mars Sample Return mission. The design circumvents the potential failure modes of a parachute terminal descent system by replacing that system with passive energy absorbing material to cushion the Mars samples during ground impact. The suggested design utilizes a spherically blunted 45 degree half-angle forebody with an ablative heatshield. The primary structure is a spherical composite sandwich enclosing carbon foam energy absorbing material. Though no demonstration test of the entire system is included, results of the testing and analysis presented indicate that the design is a viable option for the Mars Sample Return Mission.

Author

Aerodynamic Characteristics; Aerothermodynamics; Atmospheric Entry; Design Analysis; Impact Tests; Parachute Descent; Structural Analysis

20040095322 bd Systems, Inc., Huntsville, AL, USA

Solid Rocket Booster/External Tank (SRB/ET) Forward Separation Bolt Monte Carlo Analysis

Rooker, William; McDonald, Emmett J.; August 30, 2004; 123 pp.; In English

Contract(s)/Grant(s): NAS8-02045

Report No.(s): TCD20040016B; No Copyright; Avail: CASI; A06, Hardcopy

This document defines the Systems Subtask 8a.2 Deliverables for Task Directive 8, Solid Rocket Booster (SRB) Separation System Analysis and Simulation for the Solid Rocket Booster Systems Analysis Contract. This submittal is in compliance with deliverable items No. 4 & 5 (8a.2) and 18 (8.e.B) requirements outlined. Specifically, the Task 8a.2, SRB/ET Forward Separation Bolt Monte Carlo Analysis PowerPoint Presentation and Final Report Deliverable is included with the PowerPoint Presentation contained the report.

Author (revised)

Bolts; External Tanks; Monte Carlo Method; Solid Propellant Rocket Engines; Stage Separation

19
SPACECRAFT INSTRUMENTATION AND ASTRIONICS

Includes the design, manufacture, or use of devices for the purpose of measuring, detecting, controlling, computing, recording, or processing data related to the operation of space vehicles or platforms. For related information see also *06 Avionics and Aircraft Instrumentation*; for spaceborne instruments not integral to the vehicle itself see *35 Instrumentation and Photography*; for spaceborne telescopes and other astronomical instruments see *89 Astronomy*.

20040090529 NASA Langley Research Center, Hampton, VA, USA
Planning Paths Through Singularities in the Center of Mass Space
Doggett, William R.; Messner, William C.; Juang, Jer-Nan; [1998]; 11 pp.; In English
Report No.(s): AIAA Paper 98-4127; Copyright; Avail: CASI; A03, Hardcopy

The center of mass space is a convenient space for planning motions that minimize reaction forces at the robot's base or optimize the stability of a mechanism. A unique problem associated with path planning in the center of mass space is the potential existence of multiple center of mass images for a single Cartesian obstacle, since a single center of mass location can correspond to multiple robot joint configurations. The existence of multiple images results in a need to either maintain multiple center of mass obstacle maps or to update obstacle locations when the robot passes through a singularity, such as when it moves from an elbow-up to an elbow-down configuration. To illustrate the concepts presented in this paper, a path is planned for an example task requiring motion through multiple center of mass space maps. The object of the path planning algorithm is to locate the bang- bang acceleration profile that minimizes the robot's base reactions in the presence of a single Cartesian obstacle. To simplify the presentation, only non-redundant robots are considered and joint non-linearities are neglected.
Author
Center of Mass; Trajectory Planning; Robots; Space Mechanics

20
SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources. For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels, 15 Launch Vehicles and Launch Operations*, and *44 Energy Production and Conversion*.

20040086566 NASA Stennis Space Center, Bay Saint Louis, MS, USA
A Method for Calculating the Probability of Successfully Completing a Rocket Propulsion Ground Test
Messer, Bradley P.; January 05, 2004; 1 pp.; In English; 24th AIAA Aerodynamic Measurement Technology and Ground Testing Conference, 28 Jun. - 1 Jul. 2004, Portland, OR, USA
Report No.(s): EB-2003-12-00007-SSC; No Copyright; Avail: CASI; A01, Hardcopy

Propulsion ground test facilities face the daily challenges of scheduling multiple customers into limited facility space and successfully completing their propulsion test projects. Due to budgetary and schedule constraints, NASA and industry customers are pushing to test more components, for less money, in a shorter period of time. As these new rocket engine component test programs are undertaken, the lack of technology maturity in the test articles, combined with pushing the test facilities capabilities to their limits, tends to lead to an increase in facility breakdowns and unsuccessful tests. Over the last five years Stennis Space Center's propulsion test facilities have performed hundreds of tests, collected thousands of seconds of test data, and broken numerous test facility and test article parts. While various initiatives have been implemented to provide better propulsion test techniques and improve the quality, reliability, and maintainability of goods and parts used in the propulsion test facilities, unexpected failures during testing still occur quite regularly due to the harsh environment in which the propulsion test facilities operate. Previous attempts at modeling the lifecycle of a propulsion component test project have met with little success. Each of the attempts suffered form incomplete or inconsistent data on which to base the models. By focusing on the actual test phase of the tests project rather than the formulation, design or construction phases of the test project, the quality and quantity of available data increases dramatically. A logistic regression model has been developed form the data collected over the last five years, allowing the probability of successfully completing a rocket propulsion component test to be calculated. A logistic regression model is a mathematical modeling approach that can be used to describe the relationship of several independent predictor variables X(sub 1), X(sub 2),..,X(sub k) to a binary or dichotomous dependent variable Y, where Y can only be one of two possible outcomes, in this case Success or Failure. Logistic regression has primarily been used in the fields of epidemiology and biomedical research, but lends itself to many other applications. As indicated the use of logistic regression is not new, however, modeling propulsion ground test facilities using logistic regression

is both a new and unique application of the statistical technique. Results from the models provide project managers with insight and confidence into the affectivity of rocket engine component ground test projects. The initial success in modeling rocket propulsion ground test projects clears the way for more complex models to be developed in this area.
Author
Ground Tests; Probability Theory; Rocket Engines; Rocket Test Facilities; Mathematical Models; Spacecraft Propulsion

20040086730 NASA Langley Research Center, Hampton, VA, USA
Liquid Rocket Propulsion for Atmospheric Flight in the Proposed ARES Mars Scout Mission
Kuhl, Christopher A.; Wright, Henry S.; Hunter, Craig A.; Guernsey, Carl S.; Colozza, Anthony J.; [2004]; 8 pp.; In English; 40th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 11-14 Jul. 2004, Fort Lauderdale, FL, USA
Contract(s)/Grant(s): 23-762-80-PB
Report No.(s): AIAA Paper 2004-3696; No Copyright; Avail: CASI; A02, Hardcopy

Flying above the Mars Southern Highlands, an airplane will traverse over the terrain of Mars while conducting unique science measurements of the atmosphere, surface, and interior. This paper describes an overview of the ARES (Aerial Regional-scale Environmental Survey) mission with an emphasis on airplane propulsion needs. The process for selecting a propulsion system for the ARES airplane is also included. Details of the propulsion system, including system schematics, hardware and performance are provided. The airplane has a 6.25 m wingspan with a total mass of 149 kg and is propelled by a bi-propellant liquid rocket system capable of carrying roughly 48 kg of MMH/MON3 propellant.
Author
Liquid Rocket Propellants; Mars Surface; Space Missions; General Overviews; Rocket Flight

20040086994 NASA Langley Research Center, Hampton, VA, USA
Considerations Concerning the Development and Testing of In-situ Materials for Martian Exploration
Kim, M.-H. Y.; Heilbronn, L.; Thibeault, S. A.; Simonsen, L. C.; Wilson, J. W.; Chang, K.; Kiefer, R. L.; Maahs, H. G.; [2000]; 16 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Natural Martian surface materials are evaluated for their potential use as radiation shields for manned Mars missions. The modified radiation fluences behind various kinds of Martian rocks and regolith are determined by solving the Boltzmann equation using NASA Langley s HZETRN code along with the 1977 Solar Minimum galactic cosmic ray environmental model. To make structural shielding composite materials from constituents of the Mars atmosphere and from Martian regolith for Martian surface habitats, schemes for synthesizing polyimide from the Mars atmosphere and for processing Martian regolith/polyimide composites are proposed. Theoretical predictions of the shielding properties of these composites are computed to assess their shielding effectiveness. Adding high-performance polymer binders to Martian regolith to enhance structural properties enhances the shielding properties of these composites because of the added hydrogenous constituents. Laboratory testing of regolith simulant/polyimide composites is planned to validate this prediction.
Author
Binders (Materials); Composite Materials; Mars Surface; Polyimides; Regolith; Product Development; In Situ Measurement

20040087295 Texas Univ., Austin, TX, USA
Railplug Ignition System for Enhanced Engine Performance and Reduced Maintenance. Semi-Annual Technical Progress Report for April 1, 2002 to September 31, 2002
Matthews, R.; Aug. 2003; In English
Report No.(s): DE2004-822222; No Copyright; Avail: National Technical Information Service (NTIS)

During the first year of this project, three experimental subtasks and four modeling subtasks were scheduled to begin. Five of these 7 subtasks were scheduled for completion by the end of the first year. Both experimental tasks were completed on schedule. No experimental data were scheduled for the first year. The four modeling tasks are progressing well. However, two of the numerical tasks have been delayed somewhat. A simplified plasma kinetics mechanism was developed and tested against a detailed model. The agreement was quite good. A simplified kinetics mechanism for flame propagation was also developed and validated via comparisons against an elementary kinetics mechanism. Again, the agreement was quite good. The 2D spark ignition process model was exercised to ensure stability but the 3D version was not completed. Excellent progress was made on the ignition circuit model, but it is not yet finished. The delays in these two subtasks are not expected to impact the schedule for the overall project.
NTIS
Ignition Systems; Maintenance

23
CHEMISTRY AND MATERIALS (GENERAL)

Includes general research topics related to the composition, properties, structure, and use of chemical compounds and materials as they relate to aircraft, launch vehicles, and spacecraft. For specific topics in chemistry and materials see *categories 25 through 29*. For astrochemistry see category *90 Astrophysics*.

20040086145 Tulane Univ., New Orleans, LA
Amphiphilic Nanocontainers for Binding and Catalysis
Thayumanavan, Sankaran; Dec. 20, 2003; 10 pp.; In English
Contract(s)/Grant(s): DAAD19-01-1-0761
Report No.(s): AD-A424480; TR-1BHK1; ARO-41881.1-CH; No Copyright; Avail: CASI; A02, Hardcopy

The objective of the proposed work is to achieve efficient phase transfer catalysis in fluorophase. For this purpose, we had developed a new dendrimer design that can potentially be used as the amphiphilic nanocontainer. Since dendrimers are too expensive to synthesize, we are approaching novel polymers as the target nanocontainers to achieve the required properties. The dendrimer design however provides an avenue for the fundamental studies. In this report, we outline the design and synthesis of a new class of fluorocarbon based polymer micelles. The properties of these polymers are being investigated currently in our laboratories.
DTIC
Binders (Materials); Catalysis; Dendrimers

20040086688 NASA Langley Research Center, Hampton, VA, USA
Organic-Inorganic Hybrids Using Novel Phenylethynyl Imide Silanes
Park, C.; Lowther, S. E.; Smith, J. G., Jr.; [2001]; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

In this presentation, polyimide-silica hybrids using novel phenylethynyl imide silanes are reported. The phenylethynyl group is present in the organic precursor as either a pendent or an end group to bond chemically with the polyimide adhesive containing phenylethynyl groups during processing, while the silane group of the organic precursor would chemically react with the inorganic precursor through oxane bond formation. The chemical compositions of these novel hybrids were examined using X-ray mapping modes of scanning electron microscopy (SEM), which revealed a silicon gradient interphase between the high surface energy substrate and the polyimide adhesive. Novel aromatic phenylethynyl imide silanes (APEISs) and pendent phenylethynyl imide oligomeric disilanes (PPEIDSs) have been synthesized, and sol-gel solutions containing the new silanes, a phenylethynyl terminated imide oligomer (PETI-5), and an inorganic precursor were formulated to develop a gradient hybrid interphase between a titanium alloy and the adhesive. Two different sol-gel systems were investigated to develop organic-inorganic hybrids. Hybrid I was composed of an organic precursor containing both phenylethynyl and silane groups (PPEIDS) and an inorganic precursor. Functional group concentrations were controlled by the variation of the molecular weight of the imide backbone of PPEIDS. Hybrid II was composed of organic and inorganic precursors and a coupling agent containing both phenylethynyl and silane groups. Morphology and chemical composition of the hybrid interphase between the inorganic substrate and the adhesive were investigated, and the bond strength and durability were evaluated using lap shear tests at various conditions. The assessment of how the bonding at an interface is affected by various sol-gel solution compositions and environments is reported.
Author
Imides; Polyimides; Silanes; Silicon; Sol-Gel Processes; Bonding

20040086705 NASA Glenn Research Center, Cleveland, OH, USA
Development of Advanced Low Conductivity Thermal Barrier Coatings
Zhu, Dong-Ming; Miller, Robert A.; July 2004; 22 pp.; In English
Contract(s)/Grant(s): WBS 22-714-04-05; DA Proj. 1L1-62211-A-47-A
Report No.(s): NASA/TM-2004-212961; E-14433; ARL-TR-3259; No Copyright; Avail: CASI; A03, Hardcopy

Advanced multi-component, low conductivity oxide thermal barrier coatings have been developed using an approach that emphasizes real-time monitoring of thermal conductivity under conditions that are engine-like in terms of temperatures and heat fluxes. This is in contrast to the traditional approach where coatings are initially optimized in terms of furnace and burner rig durability with subsequent measurement in the as-processed or furnace-sintered condition. The present work establishes a laser high-heat-flux test as the basis for evaluating advanced plasma-sprayed and electron beam-physical vapor deposited (EB-PVD) thermal barrier coatings under the NASA Ultra-Efficient Engine Technology (UEET) Program. The candidate coating materials for this program are novel thermal barrier coatings that are found to have significantly reduced thermal

conductivities and improved thermal stability due to an oxide-defect-cluster design. Critical issues for designing advanced low conductivity coatings with improved coating durability are also discussed.
Author
Low Conductivity; Thermal Conductivity; Thermal Control Coatings

20040086708 NASA Glenn Research Center, Cleveland, OH, USA
Furnace Cyclic Oxidation Behavior of Multi-Component Low Conductivity Thermal Barrier Coatings
Zhu, Dong-Ming; Nesbitt, James A.; Barrett, Charles A.; McCue, Terry R.; Miller, Robert A.; July 2004; 24 pp.; In English
Contract(s)/Grant(s): WBS 22-714-04-05; DA Proj. 1L1-62211-A-47-A
Report No.(s): NASA/TM-2004-212962; ARL-TR-3260; E-14434; No Copyright; Avail: CASI; A03, Hardcopy

Ceramic thermal barrier coatings will play an increasingly important role in advanced gas turbine engines because of their ability to further increase engine operating temperatures and reduce cooling, thus helping achieve future engine low emission, high efficiency and improved reliability goals. Advanced multi-component zirconia-based thermal barrier coatings are being developed using an oxide defect clustering design approach to achieve the required coating low thermal conductivity and high temperature stability. Although the new composition coatings were not yet optimized for cyclic durability, an initial durability screening of the candidate coating materials was conducted using conventional furnace cyclic oxidation tests. In this paper, furnace cyclic oxidation behavior of plasma-sprayed zirconia-based defect cluster thermal barrier coatings was investigated at 1163 C using 45 min hot cycles. The ceramic coating failure mechanisms were studied using scanning electron microscopy (SEM) combined with X-ray diffraction (XRD) phase analysis after the furnace tests. The coating cyclic lifetime is also discussed in relation to coating processing, phase structures, dopant concentration, and other thermo-physical properties.
Author
Oxidation; Cycles; Low Conductivity; Thermal Conductivity; Thermal Control Coatings; Ceramic Coatings

20040087133 NASA Glenn Research Center, Cleveland, OH, USA
A New Commercializable Route for the Preparation of Single-Source Precursors for Bulk, Thin-Film, and Nanocrystallite I-III-IV Semiconductors
Banger, Kulbinder K.; Jin, Michael H. C.; Harris, Jerry D.; Fanwick, Philip E.; Hepp, Aloysius F.; [2004]; 18 pp.; In English
Contract(s)/Grant(s): WBS 319-20-A1
Report No.(s): NASA/TM-2004-212922; E-14362; No Copyright; Avail: CASI; A03, Hardcopy

We report a new simplified synthetic procedure for commercial manufacture of ternary single source precursors (SSP). This new synthetic process has been successfully implemented to fabricate known SSPs on bulk scale and the first liquid SSPs to the semiconductors CuInSe2 and AgIn(x)S(y). Single crystal X-ray determination reveals the first unsolvated ternary AgInS SSP. SSPs prepared via this new route have successfully been used in a spray assisted chemical vapor deposition (CVD) process to deposit polycrystalline thin films, and for preparing ternary nanocrystallites.
Author
Copper Selenides; Single Crystals; Indium Compounds; Thin Films; Vapor Deposition

20040087292 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA
Surface Characterization of Bulk NB: What Has Been Done, What Has Been Learnt
Kneisel, P.; 2003; In English
Report No.(s): DE2004-822207; No Copyright; Avail: National Technical Information Service (NTIS)

Electromagnetic fields penetrate only a distance of (approx) 60 nm into the surface of a superconductor such as niobium. Therefore it is obvious that the condition of a cavity surface will affect the performance of this cavity. In at least the last 30 years niobium surfaces as used in superconducting accelerating cavities have been investigated by surface characterization techniques such as scanning electron microscopy (SEM), Auger spectroscopy (AES), X-ray photon spectroscopy (XPS), energy dispersive X-ray spectroscopy (EDX), electron spectroscopy for chemical analysis (ESCA) and secondary ion mass spectrometry (SIMS). The objective of all these investigations was to establish correlations between surface conditions and cavity performances such as surface resistance and accelerating gradients. Much emphasis was placed on investigating surface topography and the oxidation states of niobium under varying conditions such as buffered chemical polishing, electropolishing, oxipolishing, high temperature heat treatment, post-purification heat treatment and 'in-situ' baking. Additional measurements were conducted to characterize the behavior of a niobium surface more relevant to rf cavities such as resonant (multipacting) and non-resonant (field emission) electron loading. A large amount of knowledge has been extracted by all these investigations; nevertheless, there is still a lack of reproducibility in cavity performance when applying the 'best'

process to a cavity surface and no clear correlation has been established between niobium surface features and cavity performance. This contribution gives a review of the attempts to characterize niobium surfaces over the last three decades and tries to extract the 'white spots' in our knowledge.
NTIS
Niobium; Topography

20040087376 National Renewable Energy Lab., Golden, CO, Santa Clara Univ., CA, USA
Hydrogen Storage in Wind Turbine Towers
Kottenstette, R.; Cotrell, J.; 2003; In English
Report No.(s): DE2003-15004717; NREL/TP-500-34656; No Copyright; Avail: National Technical Information Service (NTIS)

Low-cost hydrogen storage is recognized as a cornerstone of a renewables-hydrogen economy. Modern utility-scale wind turbine towers are typically conical steel structures that, in addition to supporting the rotor, could be used to store hydrogen. This study has three objectives: (1) Identify the paramount considerations associated with using a wind turbine tower for hydrogen storage; (2) Propose and analyze a cost-effective design for a hydrogen-storing tower; and (3) Compare the cost of storage in hydrogen towers to the cost of storage in conventional pressure vessels. The paramount considerations associated with a hydrogen tower are corrosion (in the form of hydrogen embrittlement) and structural failure (through bursting or fatigue life degradation).
NTIS
Wind Turbines; Hydrogen Embrittlement; Structural Failure

24
COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.

20040086108 Air Force Research Lab., Edwards AFB, CA
Nonlinear Characterizing of the Crack Growth Behavior in a Filled Elastomer
Liu, C. T.; Yen, M.; Jan. 2004; 9 pp.; In English
Contract(s)/Grant(s): Proj-2302
Report No.(s): AD-A424398; No Copyright; Avail: CASI; A02, Hardcopy

In this study, the crack growth behavior in a filled elastomer containing hard particles embedded in a rubbery matrix was investigated. The specimen was tested at a constant strain rate of 0.067 cm/cm/min at room temperature. Two initial crack lengths, 2.54 mm and 12.7 mm, were considered. A hybrid experimental-numerical method was used to calculate the J-integral value. The results show that the initial crack length had a significant effect on the critical J-integral value for the onset of crack growth, but had no significant effect on the subsequent crack growth behavior. They also show that a power law relationship exists between the crack growth rate and the J-integral. (6 figures, 11 refs.)
DTIC
Composite Materials; Crack Propagation; Crack Tips; Elastomers; J Integral; Nonlinearity; Structural Strain

20040086132 Georgia Inst. of Tech., Atlanta, GA
Fabrication of Dense, Near Net-Shaped W/ZrC Composites by the PRIMA-DCP process
Sandhage, Ken H.; Feb. 2004; 42 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0477
Report No.(s): AD-A424454; AFRL-SR-AR-TR-04-0329; No Copyright; Avail: CASI; A03, Hardcopy

The fundamental conversion mechanism for the following net liquid/solid displacement reaction has been examined: (Zr) + WC(s) =ZrC(s)+W(s) (1) where (Zr) refers to zirconium dissolved within a Zr-Cu melt. Such mechanistic knowledge is needed in order to be able to predict the time required, under various processing conditions, for full conversion of porous WC performs into dense ZrC/W composites (e.g., for rocket nozzle applications) by the DCP method. For this fundamental study, dense wafer of WC were prepared by hot isostatic pressing at 1850 degrees C. The wafers were then immersed in a vertical orientation in a Zr-Cu melt at temperatures in the range of 115O-1400 degrees C for times up to 24 hours. After such exposure, the polished WC surfaces were found to be coated with two reaction product layers. A layer of tungsten was observed to be

in direct contact with the WC. A second, external layer of ZrC separated the W layer from the melt.
DTIC
Composite Materials; Fabrication; Isostatic Pressure; Rocket Nozzles; Zirconium Carbides

20040086164 New Orleans Univ., LA
Investigation of Nanophase Materials for Thermoelectric Applications
Stokes, Kevin L.; O'Connor, Charles J.; Apr. 30, 2004; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-99-1-0001
Report No.(s): AD-A424526; ARO-39197.7-MS; No Copyright; Avail: CASI; A03, Hardcopy

The goal of this research project is to develop an understanding of transport properties in nanometer-scale materials and to determine if engineering a material structure using nanometer-sized particles as building blocks can increase the intrinsic thermoelectric efficiency. The project involved a close collaboration between the University of New Orleans and IBM T. J. Watson Research Center. Our major accomplishments include the chemical synthesis of nanoparticles, nanorods and nanowires of lead chalcogenide, bismuth calcogenide and bismuth antimony materials. We have also formed semiconductor nanoparticle/conducting polymer nanocomposites and studied the thermoelectric properties of these materials. We have also made contributions to new, pressure-dependent thermoelectric transport measurement techniques and chemical techniques for creating ordered nanoparticle assemblies consisting of two different nanoparticle materials.
DTIC
Thermoelectricity; Transport Properties

20040086666 NASA Langley Research Center, Hampton, VA, USA
Design and Development of a Composite Dome for Experimental Characterization of Material Permeability
Estrada, Hector; Smeltzer, Stanley S., III; [1999]; 9 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

This paper presents the design and development of a carbon fiber reinforced plastic dome, including a description of the dome fabrication, method for sealing penetrations in the dome, and a summary of the planned test series. This dome will be used for the experimental permeability characterization and leakage validation of composite vessels pressurized using liquid hydrogen and liquid nitrogen at the Cryostat Test Facility at the NASA Marshall Space Flight Center (MSFC). The preliminary design of the dome was completed using membrane shell analysis. Due to the configuration of the test setup, the dome will experience some flexural stresses and stress concentrations in addition to membrane stresses. Also, a potential buckling condition exists for the dome due to external pressure during the leak testing of the cryostat facility lines. Thus, a finite element analysis was conducted to assess the overall strength and stability of the dome for each required test condition. Based on these results, additional plies of composite reinforcement material were applied to local regions on the dome to alleviate stress concentrations and limit deflections. The dome design includes a circular opening in the center for the installation of a polar boss, which introduces a geometric discontinuity that causes high stresses in the region near the hole. To attenuate these high stresses, a reinforcement system was designed using analytical and finite element analyses. The development of a low leakage polar boss system is also investigated.
Author
Carbon Fiber Reinforced Plastics; Composite Materials; Finite Element Method; Leakage; Sealing; Stress Concentration; Thin Walled Shells; Pressure Vessels; Structural Analysis

20040086681 NASA Langley Research Center, Hampton, VA, USA
Experimental Verification of Computational Models for Laminated Composites
Harris, Charles E.; Coats, Timothy W.; Glaessgen, Edward H.; [1999]; 4 pp.; In English; Copyright; Avail: CASI; A01, Hardcopy

The objective of the research reported herein is to develop a progressive damage methodology capable of predicting the residual strength of continuous fiber-reinforced, laminated, polymer matrix composites with through-penetration damage. The fracture behavior of center-notch tension panels with thin crack-like slits was studied. Since fibers are the major load-carrying constituent in polymer matrix composites, predicting the residual strength of a laminate requires a criterion for fiber fracture. The effects on fiber strain due to other damage mechanisms such as matrix cracking and delaminations must also be modeled. Therefore, the research herein examines the damage mechanisms involved in translaminate fracture and identifies the toughening mechanisms responsible for damage growth resistance in brittle epoxy matrix systems. The mechanics of matrix cracking and fiber fracture are discussed as is the mathematical framework for the progressive damage model developed by the authors. The progressive damage analysis algorithms have been implemented into a general purpose finite element code

developed by NASA, the Computational Structural Mechanics Testbed (COMET). Damage growth is numerically simulated and the analytical residual strength predictions are compared to experimental results for a variety of notched panel configurations and materials systems.
Author
Laminates; Damage; Polymer Matrix Composites; Fracture Mechanics; Structural Analysis; Mathematical Models; Predictions

20040086682 NASA Langley Research Center, Hampton, VA, USA
Compression Response Of Notched Composite Stiffened Panels: Analyses And Experiments
Ambur, Damodar R.; McGowan, David M.; Baker, Donald J.; [1999]; 4 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy
An experimental and analytical evaluation of the compressive response of two notched composite stiffened panels representative of primary composite wing structure is presented. A three-dimensional full-field image correlation technique is used to measure the three displacement components over global and local areas of the test panels. Full-field displacement results obtained using the image correlation technique are presented and compared to experimental results and analytical results obtained using nonlinear finite element analysis. Both global and global-local image correlation results are presented and discussed.
Author
Composite Structures; Compressibility; Wing Panels; Finite Element Method

20040086684 NASA Marshall Space Flight Center, Huntsville, AL, USA
Automated Composites Processing Technology: Film Module
Hulcher, A. Bruce; Aerospace America Magazine; [2004]; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy
NASA's Marshall Space Flight Center (MSFC) has developed a technology that combines a film/adhesive laydown module with fiber placement technology to enable the processing of composite prepreg tow/tape and films, foils or adhesives on the same placement machine. The development of this technology grew out of NASA's need for lightweight, permeation-resistant cryogenic propellant tanks. Autoclave processing of high performance composites results in thermally-induced stresses due to differences in the coefficients of thermal expansion of the fiber and matrix resin components. These stresses, together with the reduction in temperature due to cryogen storage, tend to initiate microcracking within the composite tank wall. One way in which to mitigate this problem is to introduce a thin, crack-resistant polymer film or foil into the tank wall. Investigation into methods to automate the processing of thin film or foil materials into composites led to the development of this technology. The concept employs an automated film supply and feed module that may be designed to fit existing fiber placement machines, or may be designed as integral equipment to new machines. This patent-pending technology can be designed such that both film and foil materials may be processed simultaneously, leading to a decrease in part build cycle time. The module may be designed having a compaction device independent of the host machine, or may utilize the host machine's compactor. The film module functions are controlled by a dedicated system independent of the fiber placement machine controls. The film, foil, or adhesive is processed via pre-existing placement machine run programs, further reducing operational expense.
Author (revised)
Fiber Composites; Fabrication; Polymeric Films

20040086691 NASA Langley Research Center, Hampton, VA, USA
Debonding of Stitched Composite Joints: Testing and Analysis
Glaessgen, E. H.; Raju, I. S.; Poe, C. C., Jr.; [1999]; 4 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy
The effect of stitches on the failure of a single lap joint configuration was determined in a combined experimental and analytical study. The experimental study was conducted to determine debond growth under static monotonic loading. The stitches were shown to delay the initiation ofthe debond and provide load transfer beyond the load necessary to completely debond the stitched lap joint. The strain energy release rates at the debond front were calculated using a finite element-based technique. Models of the unstitched configuration showed significant values of modes I and II across the width of the joint and showed that mode III is zero at the centerline but increases near the free edge. Models of the stitched configuration showed that the stitches effectively reduced mode I to zero, but had less of an effect on modes II and III.
Author
Finite Element Method; Lap Joints; Aramid Fiber Composites; Loads (Forces); Failure Analysis

20040086732 NASA Langley Research Center, Hampton, VA, USA

Molecular Weight Effects on the Viscoelastic Response of a Polyimide

Nicholson, Lee M.; Whitley, Karen S.; Gates, Thomas S.; [2000]; 15 pp.; In English; SAMPE 2000: International SAMPE Symposium and Exhibition, 21-25 May 2000, Long Beach, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy

The effect of molecular weight on the viscoelastic performance of an advanced polymer (LaRC -SI) was investigated through the use of creep compliance tests. Testing consisted of short-term isothermal creep and recovery with the creep segments performed under constant load. The tests were conducted at three temperatures below the glass transition temperature of each material with different molecular weight. Through the use of time-aging-time superposition procedures, the material constants, material master curves and aging-related parameters were evaluated at each temperature for a given molecular weight. The time-temperature superposition technique helped to describe the effect of temperature on the timescale of the viscoelastic response of each molecular weight. It was shown that the low molecular weight materials have increased creep compliance and creep compliance rate, and are more sensitive to temperature than the high molecular weight materials. Furthermore, a critical molecular weight transition was observed to occur at a weight-average molecular weight of approximately 25000 g/mol below which, the temperature sensitivity of the time-temperature superposition shift factor increases rapidly.

Author

Polyimides; Viscoelasticity; Creep Tests; Molecular Weight; Mechanical Properties

20040086744 National Academy of Sciences - National Research Council, Hampton, VA, USA

A Method for Calculating Strain Energy Release Rates in Preliminary Design of Composite Skin/Stringer Debonding Under Multi-Axial Loading

Krueger, Ronald; Minguet, Pierre J.; OBrien, T. Kevin; Composite Structures: Theory and Practice; 2000, pp. 105-128; In English

Report No.(s): ASTM-STP-1383; Copyright; Avail: CASI; A03, Hardcopy

Three simple procedures were developed to determine strain energy release rates, G, in composite skin/stringer specimens for various combinations of uniaxial and biaxial (in-plane/out-of-plane) loading conditions. These procedures may be used for parametric design studies in such a way that only a few finite element computations will be necessary for a study of many load combinations. The results were compared with mixed mode strain energy release rates calculated directly from nonlinear two-dimensional plane-strain finite element analyses using the virtual crack closure technique. The first procedure involved solving three unknown parameters needed to determine the energy release rates. Good agreement was obtained when the external loads were used in the expression derived. This superposition technique, however, was only applicable if the structure exhibits a linear load/deflection behavior. Consequently, a second modified technique was derived which was applicable in the case of nonlinear load/deformation behavior. The technique, however, involved calculating six unknown parameters from a set of six simultaneous linear equations with data from six nonlinear analyses to determine the energy release rates. This procedure was not time efficient, and hence, less appealing. Finally, a third procedure was developed to calculate mixed mode energy release rates as a function of delamination lengths. This procedure required only one nonlinear finite element analysis of the specimen with a single delamination length to obtain a reference solution for the energy release rates and the scale factors. The delamination was subsequently extended in three separate linear models of the local area in the vicinity of the delamination subjected to unit loads to obtain the distribution of G with delamination lengths. This set of sub-problems was solved using linear finite element analyses, which resulted in a considerable reduction in CPU time compared to a series of nonlinear analyses. Although additional modeling effort is required to create the local submodel, this superposition technique is very efficient for large parametric studies, which may occur during preliminary design where multiple load combinations must be considered.

Author

Composite Structures; Skin (Structural Member); Stringers; Debonding (Materials); Axial Loads; Strain Energy Release Rate; Aircraft Structures; Strain Rate; Loads (Forces)

20040086805 NASA Langley Research Center, Hampton, VA, USA

Delamination and Stitched Failure in Stitched Composite Joints

Glaessgen, E. H.; Raju, I. S.; Poe, C. C., Jr.; [1999]; 23 pp.; In English; 40th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference and Exhibit, 12-15 Apr. 1999, Saint Louis, MO

Report No.(s): AIAA Paper 99-1247; Copyright; Avail: CASI; A03, Hardcopy

The effect of stitches on the failure of a single lap joint configuration was determined in a combined experimental and finite element study. The experimental program was conducted to determine debond growth under static monotonic loading.

The stitches were shown to delay the initiation of the debond and provide load transfer beyond the load necessary to completely debond the stitched lap joint. The experimentally determined debond length vs. applied load was used as an input parameter in the finite element analysis of both configurations. The strain energy release rates at the debond from were calculated using plate finite elements. Nonlinear fastener elements were used to model the stitches and multipoint constraints were used to model the contact problem. Models of the unstitched configuration showed significant values of modes I and II across the width of the joint and showed that mode III is zero at the centerline but increases near the free edge. Models of the stitched configuration showed that the stitches were effective in reducing mode I to zero, but had less of an effect on modes II and III.
Author
Delaminating; Lap Joints; Composite Structures; Failure Modes

20040086808 NASA Langley Research Center, Hampton, VA, USA
Response of Composite Plates with Inclined Elliptical Notches and Subjected to Axial Compression
Ambur, Damodar R.; McGowan, David M.; [1999]; 12 pp.; In English; AIAA/ASME/ASCE/AHS/ASC 40th Structures, Structural Dynamics and Materials Conference, 12-15 Apr. 1999, Saint Louis, MO, USA
Report No.(s): AIAA Paper 99-1276; Copyright; Avail: CASI; A03, Hardcopy

An analysis method for predicting the inplane stress states in anisotropic finite plates with an elliptical notch is presented. This method can be used to analyze plates with arbitrary notch orientations with respect to the plate material axes. The analysis results have been validated using finite element analysis results for unnotched composite plates and experimental and finite element analysis results for stiffened composite panels with a skin that has orthotropic properties. The good agreement between these results, until the panel exhibits nonlinear response either due to bending or initiation of damage, indicates that the present analysis method can be used to determine accurately the inplane stress states and stress concentrations at and around an elliptical notch.
Author
Anisotropic Plates; Bending; Damage; Notches; Plates (Structural Members); Stress Concentration

20040086819 NASA Langley Research Center, Hampton, VA, USA
Evaluation of the Compressive Response of Notched Composite Panels using a Full-Field Displacement Measurement System
McGowan, David M.; Ambur, Damodar R.; Hanna, T. Glen; McNeill, Stephen R.; [1999]; 12 pp.; In English; 40th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 12-15 Apr. 1999, Saint Louis, MO, USA
Report No.(s): AIAA Paper 99-1406; Copyright; Avail: CASI; A03, Hardcopy

An experimental and analytical evaluation of the compressive response of two composite, notched stiffened panels representative of primary composite wing structure is presented. A three-dimensional full-field image correlation technique is used to measure all three displacement components over global and local areas of the test panels. Point-wise and full-field results obtained using the image correlation technique are presented and compared to experimental results and analytical results obtained using nonlinear finite element analysis. Both global and global-local image correlation results are presented and discussed. Results of a simple calibration test of this image correlation technique are also presented.
Author
Composite Structures; Compressibility; Displacement Measurement; Panels; Notches

20040086824 Army Research Lab., Hampton, VA, USA
Evaluation of Carbon-Rod Reinforced Crippling Strength Specimens
Baker, Donald J.; Rousseau, Carl Q.; [1999]; 12 pp.; In English
Report No.(s): AIAA Paper 99-1282; Copyright; Avail: CASI; A03, Hardcopy

The results of an experimental and analytical investigation of the crippling strength of carbon-rod reinforced specimens are presented. One-Edge-Free and No-Edge-Free crippling specimens with width-to-thickness ratios of 6.8 to 27 and 12.6 to 45, respectively, are investigated. Empirical crippling strength design curves have been developed for carbon-rod reinforced One-Edge-Free and No-Edge-Free crippling specimens. The carbon-rod reinforced crippling strength data are compared to carbon-tape crippling strength data. The carbon-tape preliminary laminate design curves recommended by MIL-HDBK-17E provide a conservative design for the One-Edge-Free structural elements and an acceptable design for the No-Edge-Free

structural elements. Results of a nonlinear finite element analysis conducted for each configuration are presented.
Author
Carbon; Rods; Thickness Ratio; Laminates

20040086827 NASA Langley Research Center, Hampton, VA, USA
Analytical Prediction of Damage Growth in Notched Composite Panels Loaded in Axial Compression
Ambur, Damodar R.; McGowan, David M.; Davila, Carlos G.; [1999]; 12 pp.; In English; 40th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 12-15 Apr. 1999, Saint Louis, MO, USA
Report No.(s): AIAA Paper 99-1435; Copyright; Avail: CASI; A03, Hardcopy

A progressive failure analysis method based on shell elements is developed for the computation of damage initiation and growth in stiffened thick-skin stitched graphite-epoxy panels loaded in axial compression. The analysis method involves a step-by-step simulation of material degradation based on ply-level failure mechanisms. High computational efficiency is derived from the use of superposed layers of shell elements to model each ply orientation in the laminate. Multiple integration points through the thickness are used to obtain the correct bending effects through the thickness without the need for ply-by-ply evaluations of the state of the material. The analysis results are compared with experimental results for three stiffened panels with notches oriented at 0, 15 and 30 degrees to the panel width dimension. A parametric study is performed to investigate the damage growth retardation characteristics of the Kevlar stitch lines in the pan
Author
Numerical Analysis; Damage; Crack Propagation; Crack Initiation; Composite Structures; Panels

20040086832 NASA Langley Research Center, Hampton, VA, USA
Analysis of Discrete-Source Damage Progression in a Tensile Stiffened Composite Panel
Wang, John T.; Lotts, Christine G.; Sleight, David W.; [1999]; 14 pp.; In English
Report No.(s): AIAA Paper 99-1336; Copyright; Avail: CASI; A03, Hardcopy

This paper demonstrates the progressive failure analysis capability in NASA Langley s COMET-AR finite element analysis code on a large-scale built-up composite structure. A large-scale five stringer composite panel with a 7-in. long discrete source damage was analyzed from initial loading to final failure including the geometric and material nonlinearities. Predictions using different mesh sizes, different saw cut modeling approaches, and different failure criteria were performed and assessed. All failure predictions have a reasonably good correlation with the test result.
Author
Composite Structures; Damage; Failure Analysis; Finite Element Method; Stringers

20040086934 National Academy of Sciences - National Research Council, Hampton, VA, USA
A Shell/3D Modeling Technique for Delaminations in Composite Laminates
Krueger, Ronald; Proceedings of the American Society for Composites, 14th Technical Conference; 1999, pp. 843-852; In English; 14th Technical Conference, 1999; No Copyright; Avail: CASI; A02, Hardcopy

A shell/3D modeling technique was developed for which a local solid finite element model is used only in the immediate vicinity of the delamination front. The goal was to combine the accuracy of the full three-dimensional solution with the computational efficiency of a plate or shell finite element model. Multi-point constraints provide a kinematically compatible interface between the local 3D model and the global structural model which has been meshed with plate or shell finite elements. For simple double cantilever beam (DCB), end notched flexure (ENF), and single leg bending (SLB) specimens, mixed mode energy release rate distributions were computed across the width from nonlinear finite element analyses using the virtual crack closure technique. The analyses served to test the accuracy of the shell/3D technique for the pure mode I case (DCB), mode II case (ENF) and a mixed mode I/II case (SLB). Specimens with a unidirectional layup where the delamination is located between two 0 plies, as well as a multidirectional layup where the delamination is located between two non-zero degree plies, were simulated. For a local 3D model extending to a minimum of about three specimen thicknesses in front of and behind the delamination front, the results were in good agreement with mixed mode strain energy release rates obtained from computations where the entire specimen had been modeled with solid elements. For large built-up composite structures modeled with plate elements, the shell/3D modeling technique offers a great potential, since only a relatively small section in the vicinity of the delamination front needs to be modeled with solid elements.
Author
Composite Structures; Delaminating; Shells (Structural Forms); Three Dimensional Models; Mechanical Properties; Laminates

20040086937 NASA Glenn Research Center, Cleveland, OH, USA

Design Analysis and Thermo-mechanical Fatigue of a Polyimide Composite for Combustion Chamber Support

Thesken, J. C.; Melis, M.; Shin, E.; Sutter, J.; Burke, Chris; [2004]; 13 pp.; In English; High Temple Workshop, 10-13 Feb. 2003, zJacksonville, FL, USA

Contract(s)/Grant(s): 708-31-16; No Copyright; Avail: CASI; A03, Hardcopy

Polyimide composites are being evaluated for use in lightweight support structures designed to preserve the ideal flow geometry within thin shell combustion chambers of future space launch propulsion systems. Principles of lightweight design and innovative manufacturing techniques have yielded a sandwich structure with an outer face sheet of carbon fiber polyimide matrix composite. While the continuous carbon fiber enables laminated skin of high specific stiffness; the polyimide matrix materials ensure that the rigidity and durability is maintained at operation temperatures of 316 C. Significant weight savings over all metal support structures are expected. The protypical structure is the result of ongoing collaboration, between Boeing and NASA-GRC seeking to introduce polyimide composites to the harsh environmental and loads familiar to space launch propulsion systems. Design trade analyses were carried out using relevant closed form solutions, approximations for sandwich beams/panels and finite element analysis. Analyses confirm the significant thermal stresses exist when combining materials whose coefficients of thermal expansion (CTEs) differ by a factor of about 10 for materials such as a polymer composite and metallic structures. The ramifications on design and manufacturing alternatives are reviewed and discussed. Due to stringent durability and safety requirements, serious consideration is being given to the synergistic effects of temperature and mechanical loads. The candidate structure operates at 316 C, about 80% of the glass transition temperature T(sub g). Earlier thermomechanical fatigue (TMF) investigations of chopped fiber polyimide composites made this near to T(sub g), showed that cyclic temperature and stress promoted excessive creep damage and strain accumulation. Here it is important to verify that such response is limited in continuous fiber laminates.

Derived from text

Design Analysis; Thermal Stresses; Fatigue (Materials); Polyimides; Matrix Materials; Combustion Chambers

20040086939 NASA Glenn Research Center, Cleveland, OH, USA

Analyses of Failure Mechanisms in Woven Graphite/Polyimide Composites with Medium and High Modulus Graphite Fibers Subjected to In-Plane Shear

Kumosa, M.; Armentrout, D.; Rupnowski, P.; Kumosa, L.; Shin, E.; Sutter, J. K.; [2003]; 13 pp.; In English; High Temple Workshop 23, 10-13 Feb. 2003, Jacksonville, FL, USA

Contract(s)/Grant(s): F49620-00-1-0159; NSF CMS-99-77735; 708-31-16

Report No.(s): Paper G; Copyright; Avail: CASI; A03, Hardcopy

The application of the Iosipescu shear test for the room and high temperature failure analyses of the woven graphite/polyimide composites with the medium (T-650) and igh (M40J and M60J) modulus graphite fibers is discussed. The M40J/PMR-II-50 and M60J/PMR-II-50 composites were tested as supplied and after thermal conditioning. The effect of temperature and conditioning on the initiation of intralaminar damage and the shear strength of the composites was established.

Author

Failure Analysis; Graphite; Polyimides; Woven Composites; Composite Materials; Shear Strength; Modulus of Elasticity

20040086941 NASA Glenn Research Center, Cleveland, OH, USA

Plate Deformation Behavior of Polymer Matrix Composite-Ti Honeycomb-Metal Sandwiches for Pressurized Propulsion Component Applications

Bertelsen, William D.; Shin, E. eugene; Thesken, John C.; Sutter, James K.; Martin, Rich; [2004]; 24 pp.; In English; Joint Meetings of ASTM D30 Committee, Composite Materials Hand Book (MIL-HDBK-17), 27-31 Oct. 2003, Charleston, SC, USA

Contract(s)/Grant(s): 708-31-16; Copyright; Avail: CASI; A03, Hardcopy

THe objectives are: 1. To experimentally validate bi-axial plate flexural performance of PMC-Ti H/C-A286 sandwich panels for the internally pressurized RBCC combustion chamber support structure. 2. To explore ASTM 2-D plate flexure test (D 6416) to simulate the internal pressure loading and to correlate the results with analytical and FE modeling based on 2-D flexure properties.

CASI

Deformation; Polymer Matrix Composites; Sandwich Structures; Combustion Chambers; Metal Plates

20040086973 NASA Langley Research Center, Hampton, VA, USA

Dry Ribbon for Heated Head Automated Fiber Placement

Hulcher, A. Bruce; Marchello, Joseph M.; Hinkley, Jeffrey A.; Johnston, Norman J.; Lamontia, Mark A.; [2000]; 10 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

Ply-by-ply in situ processes involving automated heated head deposition are being developed for fabrication of high performance, high temperature composite structures from low volatile content polymer matrices. This technology requires (1) dry carbon fiber towpreg, (2) consolidation of towpreg to quality, placement-grade unidirectional ribbon or tape, and (3) rapid, in situ, accurate, ply-by-ply robotic placement and consolidation of this material to fabricate a composite structure. In this study, the physical properties of a candidate thermoplastic ribbon, PIXA/IM7, were evaluated and screened for suitability in robotic placement. Specifically, towpreg was prepared from PIXA powder. Various conditions (temperatures) were used to convert the powder-coated towpreg to ribbons with varying degrees of processability. Ribbon within preset specifications was fabricated at 3 temperatures: 390, 400 and 410 C. Ribbon was also produced out-of-spec by purposely overheating the material to a processing temperature of 450 C. Automated placement equipment at Cincinnati Milacron and NASA Langley was used to fabricate laminates from these experimental ribbons. Ribbons were placed at 405 and 450 C by both sets of equipment. Double cantilever beam and wedge peel tests were used to determine the quality of the laminates and, especially, the interlaminar bond formed during the placement process. Ribbon made under conditions expected to be non-optimal (overheated) resulted in poor placeability and composites with weak interlaminar bond strengths, regardless of placement conditions. Ribbon made under conditions expected to be ideal showed good processability and produced well-consolidated laminates. Results were consistent from machine to machine and demonstrated the importance of ribbon quality in heated-head placement of dry material forms. Preliminary screening criteria for the development and evaluation of ribbon from new matrix materials were validated.

Author

Carbon Fibers; Ribbons; Refractory Materials; Automatic Control; Thermoplasticity

20040086984 NASA Glenn Research Center, Cleveland, OH, USA

Mechanical Testing of PMCs under Simulated Rapid Heat-Up Propulsion Environments, II, In-Plane Compressive Behavior

Stokes, Eric H.; Shin, E. Eugene; Sutter, James K.; [2003]; 11 pp.; In English; High Temple Workshop XXIII, 10-13 Feb. 2003, Jacksonville, FL, USA

Contract(s)/Grant(s): 708-31-16; Copyright; Avail: CASI; A03, Hardcopy

Carbon fiber thermoset polymer matrix composites (PMC) with high temperature polyimide based in-situ polymerized monomer reactant (PMR) resin has been used for some time in applications which can see temperatures up to 550 F. Currently, graphite fiber PMR based composites are used in several aircraft engine components including the outer bypass duct for the GE F-404, exit flaps for the P&W F-100-229, and the core cowl for the GE/Snecma CF6-80A3. Newer formulations, including PMR-II-50 are being investigated as potential weight reduction replacements of various metallic components in next generation high performance propulsion rocket engines that can see temperatures which exceed 550 F. Extensive FEM thermal modeling indicates that these components are exposed to rapid heat-up rates (up to -200 F/sec) and to a maximum temperature of around 600 F. Even though the predicted maximum part temperatures were within the capability of PW-II-50, the rapid heat-up causes significant through-thickness thermal gradients in the composite part and even more unstable states when combined with moisture. Designing composite parts for such extreme service environments will require accurate measurement of intrinsic and transient mechanical properties and the hygrothermal performance of these materials under more realistic use conditions. The mechanical properties of polymers degrade when exposed to elevated temperatures even in the absence of gaseous oxygen. Accurate mechanical characterization of the material is necessary in order to reduce system weight while providing sufficient factors of safety. Historically, the testing of PMCs at elevated temperatures has been plagued by the antagonism between two factors. First, moisture has been shown to profoundly affect the mechanical response of these materials at temperatures above their glass transition temperature while concurrently lowering the material's Tg. Moisture phenomena is due to one or a combination of three effects, i.e., plastization of polymeric material by water, the internal pressure generated by the volatilization of water at elevated temperatures, and hydrolytic chemical decomposition. However, moisture is lost from the material at increasing rates as temperature increases. Second, because PMCs are good thermal insulators, when they are externally heated at even mild rates large thermal gradients can develop within the material. At temperatures where a material property changes rapidly with temperature the presence of a large thermal gradient is unacceptable for intrinsic property characterization purposes. Therefore, long hold times are required to establish isothermal conditions. However, in the service environments high-heating-rates, high temperatures, high-loading rates are simultaneous present along with residual moisture. In order to capture the effects of moisture on the material, holding at- temperature until

isothermal conditions are reached is unacceptable particularly in materials with small physical dimensions. Thus, the effects due to moisture on the composite's mechanical characteristics, ie., their so-called analog response, may be instructive. One approach employed in this program was rapid heat-up (approx. 200 F/sec.) and loading of both dry and wet in-plane compressive specimens to examine the effects of moisture on this resin dominated mechanical property of the material.
Author
Mechanical Properties; Polymer Matrix Composites; Carbon Fibers; Temperature Gradients

20040087097 NASA Langley Research Center, Hampton, VA, USA
Three-Dimensional Effects in the Plate Element Analysis of Stitched Textile Composites
Glaessgen, E. H.; Raju, I. S.; [1999]; 19 pp.; In English; 40th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference and Exhibit, 12-15 Apr. 1999, Saint Louis, MO, USA
Report No.(s): AIAA Paper 99-1416; Copyright; Avail: CASI; A03, Hardcopy

Three-dimensional effects related to the analysis of stitched textile composites are discussed. The method of calculation is based on the virtual crack closure technique (VCCT), and models that model the upper and lower surface of the delamination or debond with two-dimensional (2D) plate elements rather than three-dimensional (3D) solid elements. The major advantages of the plate element modeling technique are a smaller model size and simpler geometric modeling. Details of the modeling of the laminated plate and the stitching are discussed.
Author
Woven Composites; Two Dimensional Models; Three Dimensional Models; Debonding (Materials); Delaminating

20040087146 NASA Glenn Research Center, Cleveland, OH, USA
Fiber Reinforcement Architectures of PMCs on the Hygrothermal-Mechanical Performance for Aeropropulsion Applications
Shin, Eugene; Thesken, John; Sutter, James; Chuang, Kathy; Juhas, John; Veverka, A.; Inghram, L.; Burke, C.; Fink, J. E.; Arendt, C., et al.; [2003]; 12 pp.; In English; High Temple Workshop XXIII, 10-13 Feb. 2003, Jacksonville, FL, USA
Contract(s)/Grant(s): 708-31-16
Report No.(s): Paper G; No Copyright; Avail: CASI; A03, Hardcopy

A rigid lightweight sandwich support structure, for the combustor chamber of a new generation liquid propellant rocket engine, was designed and fabricated using Polymer Matric Composite (PMC) facesheet on a Ti honeycomb or Carbon foam core. The facesheet consisted of high stiffness carbon fiber, M40JB, and high temperature Polyimides, such as PMR-11-50 and HFPE-II. Six different fiber architectures; 4HS woven fabric, uni-fabric, woven-uni hybrid, stitched woven fabric, stitched uni-fabric and tri-axial braided structures have been investigated for optimum stiffness-thickness-weight-performance design criteria for the hygrothermal-mechanical propulsion service exposure conditions including rapid heating up to 200 F/sec, maximum operating temperature of 600 F, internal pressure up to 100 psi. An extensive property and performance database including dry-wet mechanical properties at both 25 F and 600 F in various loading modes, thermal and physical properties including blistering onset condition was developed for fiber architecture down-selection and design guidelines. Various optimized process methods including vacuum bag compression molding, solvent assistant RTM (SaRTM), resin film infusion (RFI) were utilized for PMC panel fabrication depending on the architecture type. In the case of stitched woven fabric architecture, the optimal stitch pattern was chosen in terms of stitch density and yarn size, based on both in-plane mechanical properties and blistering performance. Potential reduction of the in-plane properties transverse to the line of stitching was also evaluated. Attempt to correlate the experimental results with theoretical micro-mechanics predictions will be presented.
Author
Polymer Matrix Composites; Reinforcing Fibers; Hygral Properties; Liquid Propellant Rocket Engines; Sandwich Structures

20040087189 NASA Langley Research Center, Hampton, VA, USA
NASA Thermographic Inspection of Advanced Composite Materials
Cramer, K. Elliott; June 14, 2004; 7 pp.; In English; 7th International Conference on Quantitative Infrared Thermography, 5-8 Jul. 2004, Rhode Saint Genese, Belgium
Contract(s)/Grant(s): 762-60-61; No Copyright; Avail: CASI; A02, Hardcopy

As the use of advanced composite materials continues to increase in the aerospace community, the need for a quantitative, rapid, in situ inspection technology has become a critical concern throughout the industry. In many applications it is necessary to monitor changes in these materials over an extended period of time to determine the effects of various load conditions. Additionally, the detection and characterization of defects such as delaminations, is of great concern. This paper will present

the application of infrared thermography to characterize various composite materials and show the advantages of different heat source types. Finally, various analysis methodologies used for quantitative material property characterization will be discussed.
Author
Composite Materials; Thermography; Nondestructive Tests; Inspection; Loads (Forces)

20040087197 NASA Langley Research Center, Hampton, VA, USA
Fabrication Of Carbon-Boron Reinforced Dry Polymer Matrix Composite Tape
Belvin, Harry L.; Cano, Roberto J.; Treasure, Monte; Shahood, Thomas W.; [1999]; 10 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

Future generation aerospace vehicles will require specialized hybrid material forms for component structure fabrication. For this reason, high temperature composite prepregs in both dry and wet forms are being developed at NASA Langley Research Center (LaRC). In an attempt to improve compressive properties of carbon fiber reinforced composites, a hybrid carbon-boron tape was developed and used to fabricate composite laminates which were subsequently cut into flexural and compression specimens and tested. The hybrid material, given the designation HYCARB, was fabricated by modifying a previously developed process for the manufacture of dry polymer matrix composite (PMC) tape at LaRC. In this work, boron fibers were processed with IM7/LaRC(TradeMark)IAX poly(amide acid) solution-coated prepreg to form a dry hybrid tape for Automated Tow Placement (ATP). Boron fibers were encapsulated between two (2) layers of reduced volatile, low fiber areal weight poly(amide acid) solution-coated prepreg. The hybrid prepreg was then fully imidized and consolidated into a dry tape suitable for ATP. The fabrication of a hybrid boron material form for tow placement aids in the reduction of the overall manufacturing cost of boron reinforced composites, while realizing the improved compression strengths. Composite specimens were press-molded from the hybrid material and exhibited excellent mechanical properties.
Author
Boron; Boron Reinforced Materials; Carbon Fibers; Polymer Matrix Composites; Laminates; Fiber Composites

20040087337 Forest Products Lab., Madison, WI, Virginia Polytechnic Inst. and State Univ., Blacksburg, VA, USA
Fundamentals of Composite Processing: Proceedings of a Workshop
Winandy, J. E.; Kamke, F. A.; Jun. 2004; 130 pp.; In English
Report No.(s): PB2004-106730; FSGTR-FPL-149; No Copyright; Avail: CASI; A07, Hardcopy

The USDA Forest Service, Forest Products Laboratory (Madison, Wisconsin) and the Wood-Based Composites Center of Virginia Tech (Blacksburg, Virginia) co-sponsored a conference, held November 5-6, 2003, in Madison, Wisconsin, on the fundamentals of composite processing. The goals were to assess what we know, define what we need to know, and then establish the state of the art in hot-pressing of wood-based, particulate composites. Academic and industrial professionals from around North America and Europe were invited to participate because of their expertise and interest in this area of research. The workshop covered four critical topics associated with hot-pressing of composites: resin curing and bonding, press control, physics of hot-pressing, and computer simulations of the pressing process. This report is the official record of the presentations and discussions that occurred during this workshop.
NTIS
Composite Materials; Wood

25
INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

Includes the analysis, synthesis, and use of inorganic and organic compounds; combustion theory; electrochemistry; and photochemistry. For related information see category *34 Fluid Dynamics and Thermodynamics*. For astrochemistry see category *90 Astrophysics*.

20040086109 Air Force Research Lab., Edwards AFB, CA
The NH3Cl+ Cation
Schneider, Stefan; Haiges, Ralf; Schroer, Thorsten; Boatz, Jerry; Christe, Karl O.; May 21, 2004; 20 pp.; In English
Contract(s)/Grant(s): Proj-2303
Report No.(s): AD-A424401; No Copyright; Avail: CASI; A03, Hardcopy

Whereas at least seven simple inorganic cations, NH3F+,1,2 NH2F2+,3 NF4+,4 N2F+,5 N2F3+,6 ONF2+,7 and N3NOF+,8 which contain N-F bonds, have been prepared and well characterized, the existence of corresponding N-Cl

containing cations is not well established. Thus, only two N-Cl containing cations, NCl4+9 and ONCl2+,10,11 have been reported, however, our repeated attempts to duplicate their syntheses were unsuccessful, and the crystal structure, published for ONCl2+SbCl6-,10 has been challenged on theoretical grounds.12 The paucity of data on simple inorganic N-Cl containing cations can be attributed to the general explosiveness and instability of nitrogen chlorides.13-15 In this paper, the synthesis and characterization of NH3Cl+M- salts (M = BF4, AsF6, or SbF6), the first examples of compounds containing a stable, simple inorganic cation with an N-Cl bond, are reported.
DTIC
Cations; Chlorides; Nitrogen Compounds

20040086112 ManTech Environmental Technology, Inc., Dayton, OH
Data Development Strategy for Evaluation of Occupational Health Hazards of New Chemicals of Interest to the Air Force
Frazier, John M.; Dodd, Darol; Nikiforov, Andrey I.; Apr. 2000; 65 pp.; In English
Contract(s)/Grant(s): F41624-96-C-9010; Proj-2312
Report No.(s): AD-A424408; AFRL-HE-WP-TR-2003-0144; No Copyright; Avail: CASI; A04, Hardcopy

New chemicals developed for the use by the Air Force must undergo evaluation to determine if these chemicals will be detrimental to the health of Air Force personnel. Chemical safety assessment is a costly and time consuming process. This report is a description of recommended procedures for toxicity testing of new chemicals. A strategy for the progressive and logical development of toxicology data that are needed for health hazard characterization, and ultimately for risk assessment is presented. The overall cost and time requirements of the proposed testing strategy are provided. The relationship between the amount of toxicity testing conducted and the level of confidence in the toxicity classification of new chemical is emphasized.
DTIC
Hazards; Health

20040086576 NASA Langley Research Center, Hampton, VA, USA
Novel Phenylethynyl Imide Silanes as Coupling Agents for Titanium Alloy
Park, C.; Lowther, S. E.; Smith, J. G., Jr.; Conell, J. W.; Hergenrother, P. M.; SaintClair, T. L.; [2004]; 5 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The durability of titanium (Ti) alloys bonded with high temperature adhesives such as polyimides has failed to attain the level of performance required for many applications. The problem to a large part is attributed to the instability of the surface treatment on the Ti substrate. Although Ti alloy adhesive specimens with surface treatments such as chromic acid anodization, Pasa-Jell, Turco, etc. have provided high initial mechanical properties, these properties have decreased as a function of aging at ambient temperature and faster, when aged at elevated temperatures or in a hot-wet environment. As part of the High Speed Civil Transport program where Ti honeycomb sandwich structure must perform for 60,000 hours at 177 C, work was directed to the development of environmentally safe, durable Ti alloy surface treatments.
Derived from text
Titanium Alloys; Phenyls; Silanes; Polyimides; Coupling

20040086664 Savannah River Ecology Lab., Aiken, SC, USA
Using Metal Hydride to Store Hydrogen
Heung, L. K.; 2003; 9 pp.; In English
Report No.(s): DE2004-808883; WSRC-MS-2003-00172; No Copyright; Avail: Department of Energy Information Bridge

Hydrogen is the lightest element. At ambient conditions on a volume basis it stores the least amount of energy compared to other fuel carriers such as natural gas and gasoline. For hydrogen to become a practical fuel carrier, a way must be found to increase its volumetric energy density to a practical level. Present techniques being developed include compressed gas, cryogenic liquid and absorbed solid. Each of these techniques has its advantages and disadvantages. And none of them appears to be satisfactory for use in a hydrogen economy. In the interim all of them are used for demonstration purposes. Metal hydrides store hydrogen in a solid form under moderate temperature and pressure that gives them a safety advantage. They require the least amount of energy to operate. Their stored hydrogen density is nearing that of liquid hydrogen. But they are heavy and the weight is their main disadvantage. Current usable metal hydrides can hold no more than about 1.8 percent hydrogen by weight. However much effort is underway to find lighter materials. These include other solid materials other than

the traditional metal hydrides. Their operation is expected to be similar to that of metal hydride and can use the technology developed for metal hydrides.
NTIS
Metal Hydrides; Safety

20040086667 Du Pont de Nemours (E. I.) and Co., Aiken, SC, USA
Physical Property Models of Concentrated Cesium Eluate Solutions
Choi, A. S.; Edwards, T. B.; Pierce, R. A.; Apr. 2003; In English
Report No.(s): DE2004-811938; WSRC-TR-2002-00424; No Copyright; Avail: National Technical Information Service (NTIS)

Major analytes expected to be present in the WTP cesium ion-exchange eluate solutions were identified from the available analytical data collected during radioactive bench-scale runs, and a test matrix of cesium eluate solutions was designed within the bounding concentration ranges of those major analytes. A computer model describing the semi-batch evaporation of cesium eluate solutions was built using the Environmental Simulation Program (ESP), licensed by OLI Systems, Inc., and was run to calculate the physical properties of each test matrix solution concentrated to the target endpoints of 80% and 100% bulk saturation. The calculated physical properties were then analyzed statistically and fitted into predetermined mathematical expressions for the bulk solubility, density, viscosity and heat capacity as a function of temperature and feed concentration of each species considered in the matrix.
NTIS
Cesium; Environment Simulation; Evaporation; Specific Heat

20040087038 NASA Ames Research Center, Moffett Field, CA, USA
Solubility of HOBr in Acidic Solution and Implications for Liberation of Halogens Via Aerosol Processing
Iraci, Laura T.; Michelsen, R. R.; Rammer, T. A.; Ashbourn, S. F. M.; [2004]; 1 pp.; In English; 8th International Global Atmospheric Chemistry Conference, 4-9 Sep. 2004; No Copyright; Avail: Other Sources; Abstract Only

Halogen species are known to catalytically destroy ozone in several regions of the atmosphere. In addition to direct catalytic losses, bromine compounds can indirectly enhance ozone loss through coupling to other radical families. Hypobromous acid (HOBr) is a key species in the linkage of BrOx to ClOx and HOx. The aqueous- phase coupling reaction HOBr + HCI (right arrow) BrCl + H2O may provide a pathway for chlorine activation on sulfate aerosols at temperatures warmer than those required for polar stratospheric cloud formation. We have measured t h e solubility of HOBr in 45 - 70 wt% sulfuric acid solutions. Over the temperature range 201 - 252 K, HOBr is quite soluble in sulfuric acid, H* = 10(exp 4) - 10(exp 7) mol dm(exp -3) atm(exp -1). The expected inverse dependence of H* on temperature was observed, but only a weak dependence on acidity was found. The solubility of HOBr is comparable to that of HBr, indicating that equilibrium concentrations of HOBr could equal or exceed those of HBr in upper tropospheric and lower stratospheric aerosols. Despite the high solubility of HOBr, aerosol volumes are not large enough to sequester a significant fraction of inorganic bromine from the gas phase. Our measurements of HOBr uptake in aqueous sulfuric acid in the presence of other brominated gases show the evolution of gaseous products including Br2O and Br2.
Author
Acidity; Solubility; Solutions; Halogens; Aerosols; Bromine Compounds

20040087100 NASA Ames Research Center, Moffett Field, CA, USA
Search for Possible Stratospheric Bromine Reservoir Species: Theoretical Study of the Photostability of Mono-, Tri-, and Pentacoordinated Bromine Compounds
Lee, TImothy J.; Mejia, Cesar N.; Beran, J. O.; Head-Gordon, Martin; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Previous work has shown that pentacoordinated bromine compounds have their lowest excited electronic states shifted to the blue relative to monocoordinated bromine molecules, and that this shift may be large enough to render them photostable in the lower stratosphere. Our earlier work has also shown that certain pentacoordinated bromine compounds are thermodynamically stable relative to their mono- or tricoordinated isomers, suggesting that if a bromine stratospheric reservoir species exists, then it is most likely a pentacoordinated compound. In this study we have examined the singlet excited electronic states of several bromine compounds in order to assess their photostability excited states in mono-, tri-, and

pentacoordinated bromine molecules. Due to the strong spin-orbit mixing in bromine, we have also examined the lowest triplet excited state.
Author
Bromine Compounds; Stratosphere; Atmospheric Chemistry

20040087132 NASA Glenn Research Center, Cleveland, OH, USA
Synthesis and Structural Characterization of a Novel Indium Mercapto Derivative [Clln(SCH2(CO)O)2]2-[(4-MepyH)2]2+
Banger, Kulbinder K.; Duraj, Stan A.; Fanwick, Philip E.; Hepp, Aloysius F.; Martock, Robert A.; July 2004; 12 pp.; In English
Contract(s)/Grant(s): NCC3-318; NCC3-246; WBS 319-20-A1
Report No.(s): NASA/TM-2004-212289; E-13851; No Copyright; Avail: CASI; A03, Hardcopy

The synthesis and structural characterization of a novel In(III) complex is described. The reaction between InCl3 with sodium mercapto-acetic acid, (NaSCH2(CO)OH) in 4-methylpyridine, (CH3(C5H5N), (4-Mepy)) at 25 C affords [ClIn(SCH2(CO)O)2]2- [(4-MepyH)2]2+. X-ray diffraction studies show it to have a distorted square pyramidal geometry, with the [(-SCH2(CO)CO-)] ligands in a trans conformation. The compound crystallizes in the P(raised dash) 1 (No. 2) space group with a = 7.8624 Angstrom, b = 9.950 Angstrom, c = 13.793 Angstrom, alpha = 107.60 degrees, beta= 90.336 degrees, gamma = 98.983 degrees, V = 1014.3 Angstroms (sup 3), R(F(raised circle)) = 0.037, and R(sub w) = 0.048.
Author
Synthesis (Chemistry); Indium Compounds; Ligands; Crystal Structure; Thiols; Pyridines

20040089593 California Univ., Riverside, CA
Development of a Toolbox of Organic Synthetic Reactions that can be Induced on Individual Molecules by STM
Rao, B. V.; Kwon, K. Y.; Perry, R.; Nysen, L.; Pavin, G.; 2003; In English
Report No.(s): DE2003-815215; No Copyright; Avail: National Technical Information Service (NTIS)

The key scientific objective of this project is the development of a set of reliable techniques for the addressal of specific bonds of individual molecules in order to assemble functional molecules on a metal surface at single-atom precision. In the course of this project a number of halo-substituted aryls and alkyls where investigated with special concern to two properties: clean deposition of the reactants from the gas phase on metallic surfaces and STM-based addressability of individual substituents of them. In order to prevent contamination of the sample by deposition of solvent residue, a special depositions source was developed that uses a skimmed molecular beam. Exemplary substances studied were 1,3-iodobromobenzene (IBB), 3 bromopropionitrile (BPN) and 4, 4’-dibromobiphenyl (DBB). The concept of individual addressabilities of bonds in bi-substituted molecule was confirmed by use of BPN. This reactant is, however, strongly bound to the substrate and, hence, not very suitable for the assembly of larger aggregates, even if the nitrile group could be activated. We found individual activation of one of the bromines of DBB. In order for STM-based assembly of molecular structures ever to become useful, the rigid attachment of the resultant product molecules to the substrate is a requirement. We investigated the possibility of depositing aromatic thiols on Cu(111) at low enough temperature, so that the thiolates is not formed spontaneously. Subsequently, we could form the thiol substrate bonds at will on molecules that were located at desired surface location. We also identified effects of surface induced chirality on the adsorption behavior of such molecules. In summary, during this two-year project a molecule suitable for controlled intermolecular attachment was identified. The deposition of the molecules was optimized and a route to proven substrate attachment was established.
NTIS
Molecular Beams; Bonding; Metal Surfaces; Molecules

20040095309 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Absorption Reveals and Hydrogen Addition Explains New Interstellar Aldehydes: Propenal and Propanal
Hollis, J. M.; Jewell, P. R.; Lovas, F. J.; Remijan, A.; Mollendal, H.; [2004]; 10 pp.; In English
Contract(s)/Grant(s): RTOP 188-02-02-01; Copyright; Avail: CASI; A02, Hardcopy

New interstellar molecules propenal (CH2CHCHO) and propanal (CH3CH2CHO) have been detected largely in absorption toward the star-forming region Sagittarius B2(N) by means of rotational transitions observed with the 100-m Green Bank Telescope (GBT) operating in the range of 18 GHz (lambda approximately 1.7 cm) to 26 GHz (lambda approximately 1.2 cm). The GBT was also used to observe the previously reported interstellar aldehyde propynal (HC2CHO) in Sagittarius B2(N) which is known for large molecules believed to form on interstellar grains. The presence of these three interstellar

aldehydes toward Sagittarius B2(N) strongly suggests that simple hydrogen addition on interstellar grains accounts for successively larger molecular species: from propynal to propenal and from propenal to propanal. Energy sources within Sagittarius B2(N) likely permit the hydrogen addition reactions on grain surfaces to proceed. This work demonstrates that successive hydrogen addition is probably an important chemistry route in the formation of a number of complex interstellar molecules. We also searched for but did not detect the three-carbon sugar glyceraldehyde (CH2OHCHOHCHO).
Author
Aldehydes; Hydrogen; Absorption; Interstellar Chemistry

26
METALS AND METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals and metallic materials; and metallurgy.

20040086632 NASA Langley Research Center, Hampton, VA, USA
A Novel Surface Treatment for Titanium Alloys
Lowther, S. E.; Park, C.; SaintClair, T. L.; [2004]; 5 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

High-speed commercial aircraft require a surface treatment for titanium (Ti) alloy that is both environmentally safe and durable under the conditions of supersonic flight. A number of pretreatment procedures for Ti alloy requiring multi-stages have been developed to produce a stable surface. Among the stages are, degreasing, mechanical abrasion, chemical etching, and electrochemical anodizing. These treatments exhibit significant variations in their long-term stability, and the benefits of each step in these processes still remain unclear. In addition, chromium compounds are often used in many chemical treatments and these materials are detrimental to the environment. Recently, a chromium-free surface treatment for Ti alloy has been reported, though not designed for high temperature applications. In the present study, a simple surface treatment process developed at NASA/LaRC is reported, offering a high performance surface for a variety of applications. This novel surface treatment for Ti alloy is conventionally achieved by forming oxides on the surface with a two-step chemical process without mechanical abrasion. This acid-followed-by-base treatment was designed to be cost effective and relatively safe to use in a commercial application. In addition, it is chromium-free, and has been successfully used with a sol-gel coating to afford a strong adhesive bond after exposure to hot-wet environments. Phenylethynyl containing adhesives were used to evaluate this surface treatment with sol-gel solutions made of novel imide silanes developed at NASA/LaRC. Oxide layers developed by this process were controlled by immersion time and temperature and solution concentration. The morphology and chemical composition of the oxide layers were investigated using scanning electron microscopy (SEM), X-ray photoelectron spectroscopy (XPS), and Auger electron spectroscopy (AES). Bond strengths made with this new treatment were evaluated using single lap shear tests.
Derived from text
Surface Treatment; Titanium Alloys; Commercial Aircraft; Supersonic Flight

20040086735 NASA Langley Research Center, Hampton, VA, USA
Microstructural and Mechanical Characterization of Shear Formed Aluminum Alloys for Airframe and Space Applications
Troeger, L. P.; Domack, M. S.; Wagner, J. A.; [1998]; 6 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

Advanced manufacturing processes such as near-net-shape forming can reduce production costs and increase the reliability of launch vehicle and airframe structural components through the reduction of material scrap and part count and the minimization of joints. The current research is an investigation of the processing-microstructure-property relationship for shear formed cylinders of the Al-Cu-Li-Mg-Ag alloy 2195 for space applications and the Al-Cu-Mg-Ag alloy C415 for airframe applications. Cylinders which have undergone various amounts of shear-forming strain have been studied to assess the microstructure and mechanical properties developed during and after shear forming.
Author
Airframes; Aluminum Alloys; Mechanical Properties; Microstructure; Shear Strain; Technology Utilization; Forming Techniques

20040086765 NASA Langley Research Center, Hampton, VA, USA
The Growth of Small Corrosion Fatigue Cracks in Alloy 7075
Piascik, R. S.; [2001]; 6 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

The corrosion fatigue crack growth characteristics of small (less than 35 microns) surface and corner cracks in aluminum alloy 7075 is established. The early stage of crack growth is studied by performing in situ long focal length microscope (500X)

crack length measurements in laboratory air and 1% NaCl environments. To quantify the 'small crack effect' in the corrosive environment, the corrosion fatigue crack propagation behavior of small cracks is compared to long through-the-thickness cracks grown under identical experimental conditions. In salt water, long crack constant K(sub max) growth rates are similar to small crack da/dN.
Author
Aluminum Alloys; Corrosion; Crack Propagation; Fatigue (Materials)

20040086775 NASA Langley Research Center, Hampton, VA, USA
Analyses of Fatigue and Fatigue-Crack Growth under Constant- and Variable-Amplitude Loading
Newman, J. C., Jr.; [1999]; 22 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Studies on the growth of small cracks have led to the observation that fatigue life of many engineering materials is primarily crack growth from micro-structural features, such as inclusion particles, voids, slip-bands or from manufacturing defects. This paper reviews the capabilities of a plasticity-induced crack-closure model to predict fatigue lives of metallic materials using small-crack theory under various loading conditions. Constraint factors, to account for three-dimensional effects, were selected to correlate large-crack growth rate data as a function of the effective stress-intensity factor range (delta K(sub eff)) under constant-amplitude loading. Modifications to the delta K(sub eff)-rate relations in the near-threshold regime were needed to fit measured small-crack growth rate behavior. The model was then used to calculate small- and large-crack growth rates, and to predict total fatigue lives, for notched and un-notched specimens under constant-amplitude and spectrum loading. Fatigue lives were predicted using crack-growth relations and micro-structural features like those that initiated cracks in the fatigue specimens for most of the materials analyzed. Results from the tests and analyses agreed well.
Author
Crack Closure; Crack Propagation; Cracks; Fatigue (Materials); Fatigue Life; Aluminum Alloys; Stress Concentration; Titanium Alloys; Steels

20040086786 NASA Glenn Research Center, Cleveland, OH, USA
Development and Fatigue Testing of Ceramic Thermal Barrier Coatings
Zhu, Dong-Ming; Choi, Sung R.; Miller, Robert A.; July 2004; 17 pp.; In English; International Conference on Metallurgical Coatings and Thin Films, 19-23 Apr. 2004, San Diego, CA, USA
Contract(s)/Grant(s): WBS 22-714-20-09; DA Proj. 1L1-62211-A-47-A
Report No.(s): NASA/TM-2004-213083; ARL-TR-3261; E-14561; No Copyright; Avail: CASI; A03, Hardcopy

Ceramic thermal barrier coatings will play an increasingly important role in future gas turbine engines because of their ability to effectively protect the engine components and further raise engine temperatures. Durability of the coating systems remains a critical issue with the ever-increasing temperature requirements. Thermal conductivity increase and coating degradation due to sintering and phase changes are known to be detrimental to coating performance. There is a need to characterize the coating thermal fatigue behavior and temperature limit, in order to potentially take full advantage of the current coating capability. In this study, thermal conductivity and cyclic fatigue behaviors of plasma-sprayed ZrO2-8wt%Y2O3 thermal barrier coatings were evaluated under high temperature, large thermal gradient and thermal cycling conditions. The coating degradation and failure processes were assessed by real-time monitoring of the coating thermal conductivity under the test conditions. The ceramic coating crack initiation and propagation driving forces and failure modes under the cyclic thermal loads will be discussed in light of the high temperature mechanical fatigue and fracture testing results.
Author
Thermal Control Coatings; Thermal Fatigue; Thermal Conductivity; Ceramic Coatings; Gas Turbine Engines

20040086823 NASA Langley Research Center, Hampton, VA, USA
On the Use of Accelerated Aging Methods for Screening High Temperature Polymeric Composite Materials
Gates, Thomas S.; Grayson, Michael A.; Paper; [1999]; Volume 2, pp. 925-935; In English
Report No.(s): AIAA Paper 99-1296; Copyright; Avail: CASI; A03, Hardcopy

A rational approach to the problem of accelerated testing of high temperature polymeric composites is discussed. The methods provided are considered tools useful in the screening of new materials systems for long-term application to extreme environments that include elevated temperature, moisture, oxygen, and mechanical load. The need for reproducible mechanisms, indicator properties, and real-time data are outlined as well as the methodologies for specific aging mechanisms.
Author
Accelerated Life Tests; Aging (Materials); Refractory Materials; Polymers

20040086882 NASA Langley Research Center, Hampton, VA, USA

Alloys and Coating Development for Metallic TPS for Reusable Launch Vehicles

Brewer, William D.; Bird, Keith; Wallace, Terryl; Sankaran, S. A.; [2004]; 26 pp.; In English; National Space and Missile Materials Symposium, 28 Feb. - 2 Mar. 2000, San Diego, CA, USA

Report No.(s): NASA-2000-NSMMS-WDB; No Copyright; Avail: CASI; A03, Hardcopy

This presentation contains 26 slides and was presented at the National Space & Missile Materials Symposium 28 Feb.-2 Mar. in San Diego.

CASI

Thermal Protection; Heat Shielding; Reusable Heat Shielding; Heat Resistant Alloys; Protective Coatings

20040087340 NASA Langley Research Center, Hampton, VA, USA

Effects of Aging-Time Reference on the Long Term Behavior of the IM7/K3B Composite

Veazie, David R.; Gates, Thomas S.; [1998]; 8 pp.; In English

Contract(s)/Grant(s): NAG1-1727; NAGW-2939

Report No.(s): AIAA Paper 98-1962; Copyright; Avail: CASI; A02, Hardcopy

An analytical study was undertaken to investigate the effects of the time-based shift reference on the long term behavior of the graphite reinforced thermoplastic polyimide composite IM7/K3B at elevated temperature. Creep compliance and the effects of physical aging on the time dependent response was measured for uniaxial loading at several isothermal conditions below the glass transition temperature (T(sub g). Two matrix dominated loading modes, shear and transverse, were investigated in tension and compression. The momentary sequenced creep/aging curves were collapsed through a horizontal (time) shift using the shortest, middle and longest aging time curve as the reference curve. Linear viscoelasticity was used to characterize the creep/recovery behavior and superposition techniques were used to establish the physical aging related material constants. The use of effective time expressions in a laminated plate model allowed for the prediction of long term creep compliance. The effect of using different reference curves with time/aging-time superposition was most sensitive to the physical aging shift rate at lower test temperatures. Depending on the loading mode, the reference curve used can result in a more accurate long term prediction, especially at lower test temperatures.

Author

Graphite-Polyimide Composites; Reinforcing Materials; Composite Materials; Aging (Materials); High Temperature

20040087395 National Renewable Energy Lab., Golden, CO, Santa Clara Univ., CA, USA

Hydrogen Storage in Wind Turbine Towers: Design Considerations

Kottenstette, R.; Cotrell, J.; 2003; In English

Report No.(s): DE2003-15004828; NREL/CP-500-34759; No Copyright; Avail: National Technical Information Service (NTIS)

The paramount considerations associated with a hydrogen tower are corrosion (in the form of hydrogen embrittlement) and structural failure (through bursting or fatigue life degradation). Although hydrogen embrittlement (HE) requires more research and experimentation, it does not appear to prohibit the use of turbine towers for hydrogen storage. Furthermore, the structural modifications required to store hydrogen in a tower are technically feasible. We discovered that hydrogen towers have a ‘crossover pressure’ at which their critical mode of failure crosses over from fatigue to bursting. The crossover pressure for many turbine towers is between 10 and 15 atm. The cost of hydrogen storage per unit of storage capacity is lowest near the crossover pressure. Above the crossover pressure, however, storage costs rise quickly.

NTIS

Wind Turbines; Corrosion; Hydrogen Embrittlement; Hydrogen; Towers

20040090448 Argonne National Lab., IL, Michigan Univ., Ann Arbor, MI, USA

Developing Improved Structural Materials using Proton Irradiation as a Rapid Analysis Tool

2003; In English

Report No.(s): DE2003-816766; No Copyright; Avail: National Technical Information Service (NTIS)

The overall goal of the project is to develop austenitic stainless steel structural materials with enhanced radiation resistance. For this project, the term radiation resistance is being used to describe resistance to dimensional changes caused by void swelling and resistance to material failures caused by irradiation assisted stress corrosion cracking (IASCC). IASCC has been linked to both hardening and changes in grain boundary composition during irradiation. To achieve such enhanced radiation resistance, three experimental paths have been chosen: bulk composition engineering, grain boundary composition

engineering, and grain boundary structural engineering. The program involves the use of high-energy proton irradiation as a rapid screening tool to systematically test combinations of alloy composition and thermomechanical treatment conditions to isolate the controlling mechanisms and develop an understanding of how these factors can be engineered to improve material properties.
NTIS
Protons; Irradiation

27
NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials. For composite materials see *24 Composite Materials*.

20040086135 Dow Corning Corp., Midland, MI
DARPA Bio-Optic Synthetic Systems Programs: A Novel Lens System Featuring a Highly Dynamic Focal Length
Snow, Steven A.; Pernisz, Udo C.; Su, Kai; Nishida, Fumito; Lauer, Timothy M.; Jun. 11, 2004; 37 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0420
Report No.(s): AD-A424461; AFRL-SR-AR-TR-04-0332; No Copyright; Avail: CASI; A03, Hardcopy

The major goal of the project was to develop an adaptive optical system featuring a radical, dynamic and reversible change in focal length using polydimethylsiloxane (silicone) science and technology. The assertion that silicone- functional mesogens (liquid crystals), where the mesogen displayed an intrinsically high birefringence, would behave similarly and yield the necessary nematic liquid crystalline mesophase in an appropriate temperature range, was demonstrated to be a robust hypothesis. The silicone portion of the materials allowed for the tailoring of both the phase behavior and miscibility to comply to the demands of the adaptive optics application. Classes of silicone mesogens, where the mesogen was either a metallomesogen or else a highly pi-conjugated mesogen were successfully prepared. The metallomesogens did not display the required high birefringence (0.2 \h Delta n \h 0.5); however, many of the conjugated mesogens did. We conclude that for the metallomesogens, the birefringence of the materials is an extremely sensitive function of the molecular structure of the material. Although many of the materials investigated demonstrated smectic phases, we were able to prepare some showing the required nematic phase. Dispersions of select mesogens in a curable silicone polymer were prepared and demonstrated an elastomeric rheology allowing for the fabrication of mechanically- and electrically-active lenses. A crude adaptive optical device was prepared using these lenses which demonstrated a dynamic, scalable and reversible focal length.
DTIC
Adaptive Optics; Biotechnology; Elastomers; Lenses; Siloxanes

20040086138 Air Force Research Lab., Edwards AFB, CA
European Symposium on Fluporine Chemistry, Pizbab (Poland) (14th). Self Assembly of ULtrahydrophobic
Vij, Ashwani; Mabry, Joseph; Jul. 15, 2004; 53 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F04611-99-C-0025; Proj-2303
Report No.(s): AD-A424465; No Copyright; Avail: CASI; A04, Hardcopy

No abstract available
Conferences; Fluoropolymers; Hydrophobicity; Plastics; Poland; Self Assembly; Thermal Resistance

20040086150
Characterization of Physical and Chemical Properties of Marine Bioadhesives from Living Organisms and Hydrated Biofilms
Callow, J. A.; Wetherbee, R.; Callow, M. E.; Sep. 2003; 6 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-02-1-0331
Report No.(s): AD-A424486; No Copyright; Avail: CASI; A02, Hardcopy

The grant funded Dr. Wetherbee’s sabbatical at the University of Birmingham. The results of the study show that diatoms stick more strongly to hydrophobic PDMS than a hydrophilic model surface like glass, and this is reflected in a greater interaction energy between individual adhesive strands and PDMS. Thus, these results correlate well with the field observation that PDMS foul-release coatings often fail to diatom slimes. As many antifouling coatings use hydrophobicity as a major deterrent to fouling, this strategy alone may not work for diatoms, particularly over time. Rather, this may be a preferred

surface for these organisms and additional measures will be necessary to prevent their adhesion.
DTIC
Adhesives; Algae; Biofilms; Chemical Properties; Marine Biology

20040086554 NASA Langley Research Center, Hampton, VA, USA
Effects of Molecular Structure in Macroscopic Mechanical Properties of an Advanced Polymer (LARC(sup TM)-SI)
Nicholson, Lee M.; Hinkley, Jeffrey A.; Whitley, Karen S.; Gates, Thomas S.; [2004]; 5 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Mechanical testing of an advanced polymer resin with known variations in molecular weight was performed over a range of temperatures below the glass transition temperature. The elastic properties, inelastic elongation behavior, and notched tensile strength all as a function of molecular weight and test temperature were determined. It was shown that notched tensile strength is a strong function of both temperature and molecular weight, whereas stiffness is only a strong function of temperature.
Author
Molecular Structure; Mechanical Properties; Elastic Properties; Polymers

20040086570 NASA Langley Research Center, Hampton, VA, USA, Old Dominion Univ., Norfolk, VA, USA, Virginia Polytechnic Inst. and State Univ., Blacksburg, VA, USA
Matrix Characterization and Development for the Vacuum Assisted Resin Transfer Molding Process
Grimsley, B. W.; Hubert, P.; Hou, T. H.; Cano, R. J.; Loos, A. C.; Pipes, R. B.; [2001]; 12 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

The curing kinetics and viscosity of an epoxy resin system, SI-ZG-5A, have been characterized for application in the vacuum assisted resin transfer molding (VARTM) process. Impregnation of a typical carbon fiber perform provided the test bed for the characterization. Process simulations were carried out using the process model, COMPRO, to examine heat transfer and curing kinetics for a fully impregnated panel, neglecting resin flow. The predicted viscosity profile and final degree of cure were found to be in good agreement with experimental observations.
Author
Technology Assessment; Epoxy Resins; Viscosity; Resin Transfer Molding

20040086660 Lockheed Martin Engineering and Sciences Co., Hampton, VA, USA
Modified Phenylethynyl Containing Imides for Secondary Bonding: Non-Autoclave, Low Temperature Processable Adhesives
Dezern, James F., Technical Monitor; Chang, Alice C.; February 1999; 14 pp.; In English
Contract(s)/Grant(s): NAS1-96014; RTOP 537-06-32-20
Report No.(s): NASA/CR-1999-208993; No Copyright; Avail: CASI; A03, Hardcopy

As part of a program to develop structural adhesives for high performance aerospace applications, research continued on the development of modified phenylethynyl containing imides, LaRC(trademark)MPEIs. In previous reports, the polymer properties were controlled by varying the molecular weight, the amount of branching, and the phenylethynyl content and by blending with low molecular weight materials. This research involves changing the flexibility in the copolyimide backbone of the branched, phenylethynyl terminated adhesives. These adhesives exhibit excellent processability at pressures as low as 15 psi and temperatures as low as 288 C. The Ti/Ti lap shear specimens are processable in an autoclave or a temperature programmable oven under a vacuum bag at 288-300 C without external pressure. The cured polymers exhibit high mechanical properties and excellent solvent resistance. The chemistry and properties of these adhesives are presented.
Author
Adhesives; Polyimides

20040086702 NASA Langley Research Center, Hampton, VA, USA
Space Environmentally Stable Polyimides and Copolyimides
Watson, Kent A.; Connell, John W.; [2000]; 13 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Polyimides with a unique combination of properties including low color in thin films, atomic oxygen (AO), ultra-violet (UV) radiation resistance, solubility in organic solvents in the imide form, high glass transition (T(sub g)) temperatures and high thermal stability have been prepared and characterized. The polymers were prepared by reacting a novel aromatic diamine with aromatic dianhydrides in a polar aprotic solvent. The solubility of the polymers in the imide form as well as the color

density of thin films were dependent upon the chemical structure of the dianhydride. Several thin films (25-50 mm thick) prepared by solution casting of amide acid or imide solutions exhibited very low color and high optical transparency (approximately 90%) as determined by UV/visible spectroscopy. The polymers exhibited T(sub g)s \g200 C depending upon the structure of the dianhydride and temperatures of 5% weight loss approximately 500C in air as determined by dynamic thermogravimetric analysis. Thin films coated with silver/inconel were exposed to a high fluence of AO and 1000 equivalent solar hours of UV radiation. The effects of these exposures on optical properties were minor. These space environmentally durable polymers are potentially useful in a variety of applications on spacecraft such as thin film membranes on antennas, second-surface mirrors, thermal/optical coatings and multi-layer thermal insulation (MLI) blanket materials. The chemistry, physical and mechanical properties of the polymers as well as their responses to AO and UV exposure will be discussed.
Author
Polyimides; Spacecraft Construction Materials; Materials Selection; Copolymers

20040086711 NASA Glenn Research Center, Cleveland, OH, USA
Thermal Conductivity of Advanced Ceramic Thermal Barrier Coatings Determined by a Steady-State Laser Heat-Flux Approach
Zhu, Dong-Ming; Miller, Robert A.; July 2004; 18 pp.; In English; 27th International Thermal Conductivity Conference, 26-29 Oct. 2003, Knoxville, TN, USA
Contract(s)/Grant(s): WBS 22-714-30-09; DA Proj. 1L1-62211-A-47-A
Report No.(s): NASA/TM-2004-213040; E-14474; ARL-TR-3262; No Copyright; Avail: CASI; A03, Hardcopy

The development of low conductivity and high temperature capable thermal barrier coatings requires advanced testing techniques that can accurately and effectively evaluate coating thermal conductivity under future high-performance and low-emission engine heat-flux conditions. In this paper, a unique steady-state CO2 laser (wavelength 10.6 microns) heat-flux approach is described for determining the thermal conductivity and conductivity deduced cyclic durability of ceramic thermal and environmental barrier coating systems at very high temperatures (up to 1700 C) under large thermal gradients. The thermal conductivity behavior of advanced thermal and environmental barrier coatings for metallic and Si-based ceramic matrix composite (CMC) component applications has also been investigated using the laser conductivity approach. The relationships between the lattice and radiation conductivities as a function of heat flux and thermal gradient at high temperatures have been examined for the ceramic coating systems. The steady-state laser heat-flux conductivity approach has been demonstrated as a viable means for the development and life prediction of advanced thermal barrier coatings for future turbine engine applications.
Author
Thermal Conductivity; Ceramic Coatings; Thermal Control Coatings

20040086715 NASA Glenn Research Center, Cleveland, OH, USA
Thermomechanical Properties of Interface Modified M40J Carbon/PMR-II-50 Composites
Allred, Ronald E.; Shin, E. Eugene; McCorkle, Linda; Inghram, Linda; Papadopoulos, Demetrios; Wheeler, Don; Sutter, James K.; [2003]; 19 pp.; In English; High Temple Workshop 23, 10-13 Feb. 2003, Jacksonville, FL, USA
Contract(s)/Grant(s): 708-31-16; No Copyright; Avail: CASI; A03, Hardcopy

To increase performance and durability of high-temperature composites for potential rocket engine components, it is necessary to optimize wetting and interfacial bonding between high modulus carbon fibers and high-temperature polyimide resins. It has been previously demonstrated that the electro-oxidative shear treatments used by fiber manufacturers are not effective on higher modulus fibers that have fewer edge and defect sites in the surface crystallites. In addition, sizings commercially supplied on most carbon fibers are not compatible with polyimides. In this study, the surface chemistry and energy of high modulus carbon fibers (M40J and M60J, Torray) and typical fluorinated polyimide resins, such as PMR-11-50 were characterized. A continuous desizing system that uses an environmentally friendly chemical- mechanical process was developed for tow level fiber. Composites were fabricated with fibers containing the manufacturer’s sizing, desized, and further treated with a reactive finish. Results of room temperature tests show that desizing reduces interface sensitive properties compared to the manufacturer’s sizing and that subsequent surface re-treatment with reactive finish increases interface sensitive properties. Properties of thermally aged composites and composites with varying finish concentrations will also be discussed.
Author
Thermodynamics; Composite Materials; Chemical Reactions; Surface Reactions; Polyimide Resins

20040086742 NASA Langley Research Center, Hampton, VA, USA
Thermal Edge-Effects Model for Automated Tape Placement of Thermoplastic Composites
Costen, Robert C.; [2000]; 13 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Two-dimensional thermal models for automated tape placement (ATP) of thermoplastic composites neglect the diffusive heat transport that occurs between the newly placed tape and the cool substrate beside it. Such lateral transport can cool the tape edges prematurely and weaken the bond. The three-dimensional, steady state, thermal transport equation is solved by the Green's function method for a tape of finite width being placed on an infinitely wide substrate. The isotherm for the glass transition temperature on the weld interface is used to determine the distance inward from the tape edge that is prematurely cooled, called the cooling incursion Delta a. For the Langley ATP robot, Delta a = 0.4 mm for a unidirectional lay-up of PEEK/carbon fiber composite, and Delta a = 1.2 mm for an isotropic lay-up. A formula for Delta a is developed and applied to a wide range of operating conditions. A surprise finding is that Delta a need not decrease as the Peclet number Pe becomes very large, where Pe is the dimensionless ratio of inertial to diffusive heat transport. Conformable rollers that increase the consolidation length would also increase Delta a, unless other changes are made, such as proportionally increasing the material speed. To compensate for premature edge cooling, the thermal input could be extended past the tape edges by the amount Delta a. This method should help achieve uniform weld strength and crystallinity across the width of the tape.
Author
Thermoplasticity; Carbon Fibers; Temperature Effects; Heat; Heat Transfer; Weld Strength; Three Dimensional Models; Plastic Tapes; Thermal Analysis

20040086991 NASA Langley Research Center, Hampton, VA, USA
The Effect of Low Earth Orbit Atomic Oxygen Exposure on Phenylphosphine Oxide-Containing Polymers
Connell, John W.; [2000]; 12 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Thin films of phenylphosphine oxide-containing polymers were exposed to low Earth orbit aboard a space shuttle flight (STS-85) as part of flight experiment designated Evaluation of Space Environment and Effects on Materials (ESEM). This flight experiment was a cooperative effort between the NASA Langley Research Center (LaRC) and the National Space Development Agency of Japan (NASDA). The thin film samples described herein were part of an atomic oxygen exposure experiment (AOE) and were exposed to primarily atomic oxygen (~1 X 1019 atoms/cm2). The thin film samples consisted of three phosphine oxide containing polymers (arylene ether, benzimidazole and imide). Based on post-flight analyses using atomic force microscopy, X-ray photoelectron spectroscopy, and weight loss data, it was found that atomic oxygen exposure of these materials efficiently produces a phosphate layer at the surface of the samples. This layer provides a barrier towards further attack by AO. Consequently, these materials do not exhibit linear erosion rates which is in contrast with most organic polymers. Qualitatively, the results obtained from these analyses compare favorably with those obtained from samples exposed to atomic oxygen and or oxygen plasma in ground based exposure experiments. The results of the low Earth orbit atomic oxygen exposure on these materials will be compared with those of ground based exposure to AO.
Author
Environment Effects; Exposure; Low Earth Orbits; Oxygen Atoms; Phosphines; Thin Films

20040086993 NASA Langley Research Center, Hampton, VA, USA
How Molecular Structure Affects Mechanical Properties of an Advanced Polymer
Nicholson, Lee M.; Whitley, Karen S.; Gates, Thomas S.; Hinkley, Jeffrey A.; [2000]; 15 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

density was performed over a range of temperatures below the glass transition temperature. The physical characterization, elastic properties and notched tensile strength all as a function of molecular weight and test temperature were determined. For the uncrosslinked SI material, it was shown that notched tensile strength is a strong function of both temperature and molecular weight, whereas stiffness is only a strong function of temperature. For the crosslinked PETI-SI material, it was shown that the effect of crosslinking significantly enhances the mechanical performance of the low molecular weight material; comparable to that exhibited by the high molecular weight material.
Author
Molecular Structure; Mechanical Properties; Polymer Matrix Composites

20040086996 NASA Langley Research Center, Hampton, VA, USA
Tape-Drop Transient Model for In-Situ Automated Tape Placement of Thermoplastic Composites
Costen, Robert C.; Marchello, Joseph M.; [1998]; 11 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Composite parts of nonuniform thickness can be fabricated by in-situ automated tape placement (ATP) if the tape can be started and stopped at interior points of the part instead of always at its edges. This technique is termed start/stop-on-the-part, or, alternatively, tape-add/tape-drop. The resulting thermal transients need to be managed in order to achieve net shape and maintain uniform interlaminar weld strength and crystallinity. Starting-on-the-part has been treated previously. This paper continues the study with a thermal analysis of stopping-on-the-part. The thermal source is switched off when the trailing end of the tape enters the nip region of the laydown/consolidation head. The thermal transient is determined by a Fourier-Laplace transform solution of the two-dimensional, time-dependent thermal transport equation. This solution requires that the Peclet number Pe (the dimensionless ratio of inertial to diffusive heat transport) be independent of time and much greater than 1. Plotted isotherms show that the trailing tape-end cools more rapidly than the downstream portions of tape. This cooling can weaken the bond near the tape end; however the length of the affected region is found to be less than 2 mm. To achieve net shape, the consolidation head must continue to move after cut-off until the temperature on the weld interface decreases to the glass transition temperature. The time and elapsed distance for this condition to occur are computed for the Langley ATP robot applying PEEK/carbon fiber composite tape and for two upgrades in robot performance. The elapsed distance after cut-off ranges from about 1 mm for the present robot to about 1 cm for the second upgrade.
Author
Thermoplasticity; Thermal Analysis; Joints (Junctions); Glass Transition Temperature; Fiber Composites; Adhesives

20040087272 Alaska Univ., Fairbanks, AK, USA
Oxygen Transport Ceramic Membrances. Quarterly Report from July to September 2002
Bandopadhyay, S.; Nagabhushana, N.; 2003; In English
Report No.(s): DE2003-818110; No Copyright; Avail: National Technical Information Service (NTIS)

In the present quarter, the possibility of using a more complex interfacial engineering approach to the development of reliable and stable oxygen transport perovskite ceramic membranes/metal seals is discussed. Experiments are presented and ceramic/metal interactions are characterized. Crack growth and fracture toughness of the membrane in the reducing conditions are also discussed. Future work regarding this approach is proposed are evaluated for strength and fracture in oxygen gradient conditions. Oxygen gradients are created in tubular membranes by insulating the inner surface from the reducing environment by platinum foils. Fracture in these test conditions is observed to have a gradient in trans and inter-granular fracture as opposed to pure trans-granular fracture observed in homogenous conditions. Fracture gradients are reasoned to be due to oxygen gradient set up in the membrane, variation in stoichiometry across the thickness and due to varying decomposition of the parent perovskite. The studies are useful in predicting fracture criterion in actual reactor conditions and in understanding the initial evolution of fracture processes. iii
NTIS
Ceramics; Oxygen

28
PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels. For nuclear fuels see *73 Nuclear Physics.* For related information see also *07 Aircraft Propulsion and Power; 20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion.*

20040086122 Florida Agricultural and Mechanical Univ., Tallahassee, FL
The Effect of Jet Fuels on the Skin Irritation and Neuropeptide Release
Sachdeva, Mandip S.; Dec. 2003; 9 pp.; In English
Contract(s)/Grant(s): Proj-1710
Report No.(s): AD-A424424; AFRL-HE-WP-TR-2003-0155; No Copyright; Avail: CASI; A02, Hardcopy

Excised Hairless rat skin (CD(SD)Hr.Bi,Male rats) was used for permeation and absorption studies. The studies were conducted on Franz diffusion cells using 6% Brij in normal saline (37sC) as the receptor medium which was stirred with a magnetic bar at 600 rev./min. Nonane, dodecane, tetradecane, benzene and xylene (O.5ml) spiked with 2.5muCi of respective radiolabled chemical was placed in the donor compartment. The receptor samples were analyzed by Liquid scintillation counting. The cumulative amount of chemical permeated was plotted against time. The slope of linear portion of the curve (mg/cm2/hr) was determined. For absorption studies, the skin after defined exposure period was taken out from the diffusion cell. The stratum corneum was removed by tape stripping with Transpore tape. The underlying tissue was sectioned with Cryotome (Thermo-Shandon, 620 Electronic) into epidermis and dermis. The 14C and 3H samples were counted on a

scintillation counter (1219 Reckbeta, LKB Wallac). The amount of chemical remaining in the skin was expressed in mg/g of the tissue.
DTIC
Irritation; Jet Engine Fuels; Peptides; Skin (Anatomy)

20040090498 NASA Langley Research Center, Hampton, VA, USA
A Method for Sizing Booster Charges in Pyrotechnic Mechanisms
Bement, Laurence J.; [1998]; 11 pp.; In English; 34th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 13-15 Jul. 1998, Cleveland, OH, USA
Report No.(s): AIAA Paper 98-3783; Copyright; Avail: CASI; A03, Hardcopy

Since no generally accepted guidelines exist on sizing booster charges to assure functional margins in pyrotechnically actuated devices, a study was conducted to provide an approach to meet this need. An existing pyrovalve was modified from a single cartridge input to a dual-cartridge input with a booster charge. The objectives of this effort were to demonstrate an energy-based functional margin approach for sizing booster charges, and to determine booster charge energy delivery characteristics in this valve. Functional margin was demonstrated by determining the energy required to actuate the valve through weight drop tests for comparison to the energy delivered by the cartridge and booster charge in firings in the modified valve. The results of this study indicated that this energy-based approach fully met the study objectives, showing its usefulness for this and possibly other pyrotechnic devices.
Author
Boosters (Explosives); Pyrotechnics; Control Valves; Firing (Igniting); Charging

29
SPACE PROCESSING

Includes space-based development of materials, compounds, and processes for research or commercial application. Also includes the development of materials and compounds in simulated reduced-gravity environments. For legal aspects of space commercialization see *84 Law, Political Science and Space Policy*.

20040095868 California Univ., Los Angeles, CA, USA
Transition from Pool to Flow Boiling: The Effect of Reduced Gravity
Dhir, Vijay K.; [2004]; 19 pp.; In English
Contract(s)/Grant(s): NAG3-2397; No Copyright; Avail: CASI; A03, Hardcopy

Applications of boiling heat transfer in space can be found in the areas of thermal management, fluid handling and control, power systems, on-orbit storage and supply systems for cryogenic propellants and life support fluids, and for cooling of electronic packages for power systems associated with various instrumentation and control systems. Recent interest in exploration of Mars and other planets, and the concepts of in-situ resource utiliLation on Mars highlights the need to understand the effect of gravity on boiling heat transfer at gravity levels varying from 1\g= g/g(sub e) \g=10(exp -6). The objective of the proposed work was to develop a mechanistic understanding of nucleate boiling and critical heat flux under low and micro-gravity conditions when the velocity of the imposed flow is small. For pool boiling, the effect of reduced gravity is to stretch both the length scale as well as the time scale for the boiling process. At high flow velocities, the inertia of the liquid determines the time and the length scales and as such the gravitational acceleration plays little role. However, at low velocities and at low gravity levels both liquid inertia and buoyancy are of equal importance. At present, we have little understanding of the interacting roles of gravity and liquid inertia on the nucleate boiling process. Little data that has been reported in the literature does not have much practical value in that it can not serve as a basis for design of heat exchange components to be used in space. Both experimental and complete numerical simulations of the low velocity, low-gravity nucleate boiling process were carried out. A building block type of approach was used in that first the growth and detachment process of a single bubble and flow and heat transfer associated with the sliding motion of the bubble over the heater surface after detachment was studied. Liquid subcooling and flow velocity were varied parametrically. The experiments were conducted at 1 g(sub e), while varying the orientation of surface with respect to the gravity vector. In the laboratory experiments, holographic interferometry was used to obtain data on velocity and temperature fields associated with a bubble prior to, and after detachment and during sliding motion. A test rig for conducting experiments in the KC-135 was developed, but experiments could not be conducted due to the unavailability of the aircraft prior to completion of the project. Numerical

simulations modeling the micro and macro regions of the bubble were carried out in three dimensions. The results of the experiments were used to validate analytical/numerical models.
Derived from text
Boiling; Buoyancy; Gravitational Effects; Microgravity

31
ENGINEERING (GENERAL)

Includes general research topics related to engineering and applied physics, and particular areas of vacuum technology, industrial engineering, cryogenics, and fire prevention. For specific topics in engineering see *categories 32 through 39*.

20040086173 Army Test and Evaluation Command, Aberdeen Proving Ground, MD
Standardized UXO Technology Demonstration Site Blind Grid Scoring Record No. 159
May 2004; 65 pp.; In English
Contract(s)/Grant(s): Proj-DTC-8-CO-160-UXO-021
Report No.(s): AD-A424549; ATC-8761; No Copyright; Avail: CASI; A04, Hardcopy

Technologies under development for the detection and discrimination of unexploded ordnance (UXO) require testing so that their performance can be characterized. To that end, Standardized Test Sites have been developed at Aberdeen Proving Ground (APG), Maryland and U.S. Army Yuma Proving Ground (YPG), Arizona. These test sites provide a diversity of geology, climate, terrain, and weather as well as diversity in ordnance and clutter. Testing at these sites is independently administered and analyzed by the government for the purposes of characterizing technologies, tracking performance with system development, comparing performance of different systems, and comparing performance in different environments.
DTIC
Ammunition; Ordnance; Scoring; Standardization

20040086602 Amsterdam Univ., Netherlands
Aging Dynamics of Translational and Rotational Diffusion in a Colloidal Glass
Jabbari-Farouji, S.; Eiser, E.; Wegdam, G.; Bonn, D.; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 8; In English; See also 20040086587; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We study the dynamics of translational and rotational diffusion during the aging of the colloidal glass of Laponite using polarized and depolarized dynamic light scattering. The dynamics are qualitatively very similar between the two degrees of freedom. The short-time diffusion is independent of the time elapsed since the sample preparation. The intermediate- and long-time diffusion, on the other hand, changes over several orders of magnitude during the aging, the slowing down of the rotational diffusion being much faster than that of the translational diffusion.
Author
Aging; Dynamic Characteristics; Glass; Diffusion; Rotating Liquids

20040086615 Fribourg Univ., Switzerland
Multiple Light Scattering Probes of Fluid and Solid Soft Materials
Scheffold, Frank; Cardinaux, Frederic; Vavrin, Ronny; Schurtenberger, Peter; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 23-25; In English; See also 20040086587; No Copyright; Avail: CASI; A01, Hardcopy

We report on recent advances in single and multi-speckle Diffusing Waves Spectroscopy. Special emphasis is given to slowly relaxing or completely arrested systems, such as dense surfactant solutions or colloidal gels.
Author
Light Scattering; Colloids; Gels; Fluid Flow

20040086875 NASA Ames Research Center, Moffett Field, CA, USA
Case Study of 'Engineering Peer Meetings' in JPL's ST-6 Project
Tumer, Irem Y.; Chao, Lawrence P.; November 20, 2003; 17 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

This design process error-proofing case study describes a design review practice implemented by a project manager at NASA Jet Propulsion Laboratory. There are many types of reviews at NASA: required and not, formalized and informal, programmatic and technical. Standing project formal reviews such as the Preliminary Design Review (PDR) and Critical Design Review (CDR) are a required part of every project and mission development. However, the engineering peer reviews

that support teams technical work on such projects are often informal, ad hoc, and inconsistent across the organization. This case study discusses issues and innovations identified by a project manager at JPL and implemented in 'engineering peer meetings' for his group.
Author
Design Analysis; Errors

20040086893 NASA Langley Research Center, Hampton, VA, USA
Innovative Design of Complex Engineering Systems
Noor, Ahmed K., Compiler; July 2004; 285 pp.; In English; Innovative Design of Complex Engineering Systems, 23-24 Mar. 2004, Hampton, VA, USA; See also 20040086894 - 20040086903
Contract(s)/Grant(s): WU 755-80-00-01
Report No.(s): NASA/CP-2004-213244; L-19032; No Copyright; Avail: CASI; A13, Hardcopy

The document contains the proceedings of the training workshop on Innovative Design of Complex Engineering Systems. The workshop was held at the Peninsula Higher Education Center, Hampton, Virginia, March 23 and 24, 2004. The workshop was jointly sponsored by Old Dominion University and NASA. Workshop attendees came from NASA, other government agencies, industry and universities. The objectives of the workshop were to a) provide broad overviews of the diverse activities related to innovative design of high-tech engineering systems; and b) identify training needs for future aerospace work force development in the design area. The format of the workshop included fifteen, half-hour overview-type presentations, a panel discussion on how to teach and train engineers in innovative design, and three exhibits by commercial vendors.
Author
Aerospace Systems; Aerospace Engineering; Design; Complex Systems

20040086894 Old Dominion Univ., Hampton, VA, USA
Perspectives on Innovative Design of Complex Engineering Systems
Noor, Ahmed K.; Innovative Design of Complex Engineering Systems; July 2004, pp. 1-29; In English; See also 20040086893; No Copyright; Avail: CASI; A03, Hardcopy

Economic stresses and a very competitive market are forcing many industries to reduce cost and development time, and to insert emerging technologies into their products. Engineers are asked to design faster, ever more complex systems. They must find globally optimal designs that take uncertainties and risk into consideration. Over the last few years, a number of methodologies and technologies have been developed and utilized to support these efforts. Also, a number of approaches have been proposed for design education and training. An attempt is made in this presentation to give a broad overview of the activities on innovative design and to set the stage for succeeding presentations. The presentation is divided into four parts. In the first part, examples of future aerospace systems are given, along with some of their major characteristics and enabling technologies. The second part provides a brief overview of some of the current activities on innovative design of complex engineering systems. The third part describes a vision for future innovative design along with the key components of the innovative design process. The fourth part lists the objectives of the workshop and some of the sources of information on innovative design.
Author
Aerospace Systems; Complex Systems; Systems Engineering

20040086897 National Science Foundation, Arlington, VA, USA
Design Education for the Aerospace Workforce
Hazelrigg, George A.; Innovative Design of Complex Engineering Systems; July 2004, pp. 223-247; In English; See also 20040086893; No Copyright; Avail: CASI; A03, Hardcopy

Design is what defines engineering as an activity separate from the sciences. Yet design, while practiced for millennia, is perhaps the least well defined of the 'engineering sciences,' and many people would insist that it is not a science at all. I want to take a few minutes to put design in perspective and discuss where we might go with design education.
Author
Design; Education; Aerospace Engineering

20040086898 Ohio State Univ., Columbus, OH, USA
Teaching Design Across Disciplines
Lilly, Blaine; Innovative Design of Complex Engineering Systems; July 2004, pp. 249-272; In English; See also 20040086893; No Copyright; Avail: CASI; A03, Hardcopy

I mention my background here because I believe it's relevant to how I approach teaching. My experience as an apprentice tool and die maker at General Motors 25 years ago has affected how I view teaching and learning. My goal as a teacher has been to try to bring part of the 'one on one' apprenticeship experience into my classroom in one of the largest universities in the U.S..

Derived from text

University Program; Education; Engineers; Design

20040086901 Maryland Univ., Baltimore, MD, USA

Formalizing Conceptual Design

Wood, William; Innovative Design of Complex Engineering Systems; July 2004, pp. 157-179; In English; See also 20040086893; No Copyright; Avail: CASI; A03, Hardcopy

Because of its influence on all downstream processes, conceptual design is a critical part of the design process. The informal nature of information in conceptual design provides distinct challenges for formalization. This presentation introduces a view of conceptual design based in both descriptive research (what designers actually do) and prescriptive research (what, in a rational world, designers should do). This leads to a framework for design built around recognizing uncertainty in the requirements for the design and selectively reducing this uncertainty as design alternatives are initiated, developed and selected. The techniques presented include methods for modeling the design/requirement space; developments of normative decision theory both for formalizing the selection of design alternatives and the refinement of design requirements to support this selection; and the adaptation of methods form communication theory to provide rich measures of the size of a design space. Together, these techniques provide a framework for formalizing conceptual design that embraces the uncertainty and informality inherent to the process.

Author

Design; Decision Making

20040086902 Stanford Univ., Stanford, CA, USA

Future Challenges in Innovation Practices: A View from Engineering Design Research

Mabogunje, Ade; Innovative Design of Complex Engineering Systems; July 2004, pp. 181-192; In English; See also 20040086893; No Copyright; Avail: CASI; A03, Hardcopy

In a time when access to information is unrivaled compared to earlier times, have we become more creative as engineers or more conservative? Are today's engineers in the aerospace industries making more discoveries and innovations today when compared to engineers in the 1960s? What are the changes in work spaces, work practices, and management practices between then and now? It has been suggested that the information revolution is in reality more of a control revolution, and as managers we have unconsciously become more controlling as our knowledge of the domain has shrank relatively to the relevant knowledge. Bringing in a project on time and under budget has made the calendar and the spreadsheet about the only tools we understand. But management is not the only one to blame. As engineers we have become simply overwhelmed by the amount of important and relevant information that is out there and all too conscious of the limits of what we can do within the constraints of any given project. Is there a way out?

Author

Aerospace Engineering; Design; Research Management

20040087271 NASA Langley Research Center, Hampton, VA, USA

A Feasibility Study of Synthesizing Subsurfaces Modeled with Computational Neural Networks

Wang, John T.; Housner, Jerrold M.; Szewczyk, Z. Peter; [1998]; 9 pp.; In English

Report No.(s): AIAA Paper 98-1778; Copyright; Avail: CASI; A02, Hardcopy

This paper investigates the feasibility of synthesizing substructures modeled with computational neural networks. Substructures are modeled individually with computational neural networks and the response of the assembled structure is predicted by synthesizing the neural networks. A superposition approach is applied to synthesize models for statically determinate substructures while an interface displacement collocation approach is used to synthesize statically indeterminate substructure models. Beam and plate substructures along with components of a complicated Next Generation Space Telescope (NGST) model are used in this feasibility study. In this paper, the limitations and difficulties of synthesizing substructures modeled with neural networks are also discussed.

Derived from text

Neural Nets; Substructures; Spaceborne Telescopes

Includes radar; radio, wire, and optical communications; land and global communications; communications theory. For related information see also 04 Aircraft Communications and Navigation; and *17 Space Communications, Spacecraft Communications, Command and Tracking*; for search and rescue, see *03 Air Transportation and Safety*; and *16 Space Transportation and Safety*.

20040086143 RAND Corp., Santa Monica, CA
Future Army Bandwidth Needs and Capabilities
Joe, Leland; Porche, Isaac, III; Jan. 2004; 127 pp.; In English
Contract(s)/Grant(s): DASW01-01-C-0003
Report No.(s): AD-A424478; No Copyright; Avail: CASI; A07, Hardcopy

Across the services, there is an increasing demand for communications capacity. For the U.S. Army, this is a result of the Army's transition to a new force structure that will be knowledge-based and network-centric. Since bandwidth facilitates communications capacity, bandwidth has become increasingly critical. To the user, high bandwidth is useful because it supports increased capacity, high-volume data exchange, short delays, and high assurance of connectivity. New technologies, commercial and military, will continue to increase available bandwidth and hence the communications capacity available to users. Based on specified requirements and proposed technologies and architectures for the future force, the capacity of communications systems planned to support the new force structure will continue to fall short of the required demand. With unlimited spectrum and unlimited budget, the Army could resolve its bandwidth issues. But these are unrealistic assumptions. Certainly, demand reduction can help close the gap between the requirements and availability of network capacity. However, it is not clear how much demand reduction is possible while retaining the information dominance that is critical for the future force. Demand reduction will need to be coupled with technology investments (e.g., satellites, UAVs, directional antennas, more radios). A number of technologies and concepts are being developed to enhance spectral efficiency, thus allowing the Army to make the best use of the available spectrum. Gaps between the supply and demand of capacity, both now and in the future, will have to be addressed by constantly reassessing demand for capacity and developing technologies that increase the supply.
DTIC
Amount; Bandwidth; Broadband; Communication Networks

20040086156 Rensselaer Polytechnic Inst., Troy, NY
Streaming Video Compression for Heterogeneous Networks
Woods, John W.; Kalyanaraman, Shivkumar; Apr. 20, 2004; 41 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-00-1-0559
Report No.(s): AD-A424493; ARO-40471.2-EL; No Copyright; Avail: CASI; A03, Hardcopy

This is the final report on ARO grant DAAD 19-00-1- 0559 titled 'Streaming Video Compression for Heterogeneous Networks' and dated 1 October 2000 - 31 December 2003 We present a review of our activities during this three-year project, which treats robust video transmission of compressed video and focuses on highly scalable video compression combined with FEC and intelligent buffer management. In the latter part of the grant, we interacted with the international video standards group MPEG on the establishment of a robust scalable video coder (SVC) standard.
DTIC
Data Compression; Heterogeneity; Image Processing; Video Compression

20040086167 Naval Postgraduate School, Monterey, CA
An Investigation of a Multiple-Input-Multiple- Output Communication System With the Alamouti Space-Time Code
Turpin, Michael J.; Jun. 2004; 113 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424531; No Copyright; Avail: CASI; A06, Hardcopy

This thesis investigates the fundamentals of multiple-input-multiple-output (MIMO) radio communication systems with space-time codes. A MIMO systems was designed using the Alamouti space-time code. The modulation technique was binary phase-shift keying (BPSK). Matlab with Simulink was used to simulate the design, which was tested in both an additive white Gaussian noise (AWGN) channel and ill a multipath fading channel with AWGN. Theoretical performance was derived for both channels and compared to simulated results. The original receiver design was changed to incorporate a maximal-ratio

combiner (MRC) receiving technique with channel state information (CSI). The theoretical performance for this design was determined and compared to simulated and published results.
DTIC
Mimo (Control Systems); Telecommunication

20040086193 Naval Postgraduate School, Monterey, CA
Radio Channel Modeling for Mobile Ad Hoc Wireless Networks
Hie, Sng S.; Jun. 2004; 91 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424593; No Copyright; Avail: CASI; A05, Hardcopy

The radio channel places fundamental limitations on the performance of mobile ad hoc wireless networks. In the mobile radio environment, fading due to multipath delay spread impairs received signals. The purpose of this thesis is to develop a radio channel model and examine the effect of various parameters on channel behavior that is representative of environments in which mobile ad hoc wireless networks operate. The various physical phenomena considered are outdoor environment, fading and multipath propagation, type of terrains, and mobility (Doppler shift). A channel model based on a Tapped Delay Line (TDL) structure was developed and implemented in the MATLAB programming language, and the performance of the time-varying channel was studied by plotting the signal constellations. The simulation results indicate that the number of taps required in the TDL is 8 or less and the carrier frequency did not influence the performance significantly. The Jakes Doppler spectrum should be used in urban environments with high mobility, the Gaussian Doppler spectrum is the choice for low mobility urban environments and for the hilly terrain under both low and high mobility.
DTIC
Radio Frequencies; Radiotelephones

20040086255 Naval Postgraduate School, Monterey, CA
Network Centric Warfare: A Realistic Defense Alternative for Smaller Nations?
Berglund, Jan; Jun. 2004; 160 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424706; No Copyright; Avail: CASI; A08, Hardcopy

This thesis establishes an analytical framework for identifying and discussing strategic factors considered important when implementing Network Centric Warfare (NCW) as a new warfighting concept for the information age. Although the findings have a broad application, the focus is on NCW implementation in the NATO Alliance's small countries, and in Norway in particular. A key question is if the emerging NCW concept is a feasible defense alternative for smaller nations. Central to the study are factors found in the strategic environment, such as Norway's strategic freedom of maneuver, its affiliation with NATO, the impact of national interests, economic and technological assumptions, and the cultural premises that underlie the power of information. The changing features in the nature of conflict and in future potential opponents also will influence NCW mission challenges, opportunities, and constraints. A particularly important mission challenge is the neglected military view of low- intensity conflicts as 'worthy' military missions as well as the sociological impact on networked actors and opponents, as conditioned by new trends in the information age. A key finding is that NCW, which also takes into consideration the impact of other strategic factors discussed in this thesis, has the potential to rise to the many challenges and achieve many of the objectives currently 'floating' in existing military transformation strategies. (2 tables, 12 figures, 86 refs.)
DTIC
Command and Control; Defense Program; Norway

20040086262 Naval Postgraduate School, Monterey, CA
Junior Officer Oral Communication in the Navy and Marine Corps
Long, John M.; Jun. 2004; 119 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424715; No Copyright; Avail: CASI; A06, Hardcopy

Communication is an essential skill for every military officer. Their jobs are accomplished through communication as they motivate soldiers and sailors, who in turn physically accomplish the diverse missions of the military. Junior officers in the Navy and Marine Corps hold key and challenging positions in any ship or unit. While they rarely originate any major initiatives or missions, they almost always give the final order or direction. Therefore they must be able to accurately communicate both up and down the chain of command. While communicating comes easily to some junior officers, many struggle with it, and most have room for improvement. The USNA recognizes the important role that it can play in developing junior officer communication abilities. One of the Academy's strategic initiatives is Oral and Written Communications Excellence. The focus of this thesis is oral communications. This thesis will identify what type of oral communications are

prevalent in the fleet, what the important communication skills are that a junior officer must master, and how the Naval Academy and other institutions can help develop these skills in the future leaders of the Navy and Marine Corps.
DTIC
Education; Navy; Voice Communication

20040086263 Naval Postgraduate School, Monterey, CA
An Analysis of Degraded Communications in the Army's Future Force
Lindquist, Joseph M.; Jun. 2004; 130 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424717; No Copyright; Avail: CASI; A07, Hardcopy

The US Department of Defense is currently pursuing the most comprehensive transformation of its forces since the early years of WWII. This transformation is a holistic approach to update both the equipment that the forces will fight its conflicts with and the way in which they will fight. This transformation relies heavily on fully networked air, ground and space based platforms. While many experts agree that in the course of the next 10 years communications equipment will emerge to support the networking of these systems, there remains much uncertainty on how operations will be effected if the technology does not mature enough to meet expectations. This research shows that even a 25 percent degradation in communications range could pose significant challenges for this Future Force. Additionally, even small delays (latencies greater than one minute) and constraints on network throughput can increase the Future Force casualties and the duration of battle. While the end result in all analysis shows that the Future Force is a superior element with the same battle end state victory, the cost of that victory depends significantly on effective communications.
DTIC
Communication Networks

20040086266 Naval Postgraduate School, Monterey, CA
Performance of Coherent and Noncoherent RAKE Receivers With Convolutional Coding Ricean Fading and Pulse-Noise Interference
Kowalske, Kyle; Jun. 2004; 105 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424730; No Copyright; Avail: CASI; A06, Hardcopy

The performance of coherent and noncoherent RAKE receivers over a fading channel in the presence of pulse-noise interference and additive white Gaussian noise is analyzed. Coherent RAKE receivers require a pilot tone for coherent demodulation. Using a first order phase-lock-loop to recover a pilot tone with additive white Gaussian noise causes phase distortions at the phase-lock-loop output, which produce an irreducible phase noise error floor for soft decision Viterbi decoding. Both coherent and noncoherent RAKE receivers optimized for additive white Gaussian noise perform poorly when pulse-noise interference is present. When soft decision convolutional coding is considered, the performance degrades as the duty cycle of the pulse-noise interference signal decreases. The reverse is true for hard decision Viterbi decoding, since fewer bits experience interference and bit errors with high noise variance cannot dominate the decision statistics. Soft decision RAKE receiver optimized for pulse- noise interference and additive white Gaussian noise performed the best for both the coherent and noncoherent RAKE receivers. This receiver scales the received signal by the inverse of the variance on a bit-by-bit basis to minimize the effect of pulse- noise interference. The efficacy is demonstrated by analytical results, which reveal that this receiver reduces the probability of bit error down to the irreducible phase noise error floor when pulse-noise interference is present. This demonstrates how important it is to design the receiver for the intended operational environment.
DTIC
Coding; Fading; Performance Prediction; Receivers; Reliability Engineering

20040086276 Naval Postgraduate School, Monterey, CA
Convergence of the Naval Information Infrastructure
Knoll, James A.; Jun. 2004; 279 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424748; No Copyright; Avail: CASI; A13, Hardcopy

Converging voice and data networks has the potential to save money and is the main reason Voice over Internet Protocol (VoIP) is quickly becoming mainstream in corporate America. The potential VoIP offers to more efficiently utilize the limited connectivity available to ships at sea makes it an attractive option for the Navy. This thesis investigates the usefulness of VoIP for the communications needs of a unit level ship. This investigation begins with a review of what VoIP is and then examines the ship to shore connectivity for a typical unit level ship. An OMNeT++ model was developed and used to examine the issues

that affect implementing VoIP over this type of link and the results are presented.
DTIC
Communication Networks; Convergence; Voice Communication

20040086563 NASA Langley Research Center, Hampton, VA, USA
Portable Wireless Device Threat Assessment for Aircraft Navigation Radios
Nguyen, Truong X.; Koppen, Sandra V.; Ely, Jay J.; Williams, Reuben A.; Smith, Laura J.; Salud, Maria Theresa P.; [2004]; 6 pp.; In English; IEEE International Symposium on Electromagnetic Compatibility, 9-13 Aug. 2044, Santa Clara, CA, USA
Contract(s)/Grant(s): DFTA03-96-X-9000; 23-728-01-03; No Copyright; Avail: CASI; A02, Hardcopy

This paper addresses the concern for Wireless Local Area Network devices and two-way radios to cause electromagnetic interference to aircraft navigation radio systems. Spurious radiated emissions from various IEEE 802.11a, 802.11b, and Bluetooth devices are characterized using reverberation chambers. The results are compared with baseline emissions from standard laptop computer and personal digital assistants (PDAs) that are currently allowed for use on aircraft. The results indicate that the WLAN devices tested are not more of a threat to aircraft navigation radios than standard laptop computers and PDAs in most aircraft bands. In addition, spurious radiated emission data from seven pairs of two-way radios are provided. These two-way radios emit at much higher levels in the bands considered. A description of the measurement process, device modes of operation and the measurement results are reported.
Author
Local Area Networks; Navigation Aids; Radio Equipment; Wireless Communication

20040086724 NASA Glenn Research Center, Cleveland, OH, USA
Developing Architectures and Technologies for an Evolvable NASA Space Communication Infrastructure
Bhasin, Kul; Hayden, Jeffrey; July 2004; 20 pp.; In English; 22nd International Communications Satellite Systems Conference and Exhibit, 9-12 May 2004, Monterey, CA, USA
Contract(s)/Grant(s): WBS 22-302-20-2Z
Report No.(s): NASA/TM-2004-213108; AIAA Paper 2004-3253; E-14583; No Copyright; Avail: CASI; A03, Hardcopy

Space communications architecture concepts play a key role in the development and deployment of NASA's future exploration and science missions. Once a mission is deployed, the communication link to the user needs to provide maximum information delivery and flexibility to handle the expected large and complex data sets and to enable direct interaction with the spacecraft and experiments. In human and robotic missions, communication systems need to offer maximum reliability with robust two-way links for software uploads and virtual interactions. Identifying the capabilities to cost effectively meet the demanding space communication needs of 21st century missions, proper formulation of the requirements for these missions, and identifying the early technology developments that will be needed can only be resolved with architecture design. This paper will describe the development of evolvable space communication architecture models and the technologies needed to support Earth sensor web and collaborative observation formation missions; robotic scientific missions for detailed investigation of planets, moons, and small bodies in the solar system; human missions for exploration of the Moon, Mars, Ganymede, Callisto, and asteroids; human settlements in space, on the Moon, and on Mars; and great in-space observatories for observing other star systems and the universe. The resulting architectures will enable the reliable, multipoint, high data rate capabilities needed on demand to provide continuous, maximum coverage of areas of concentrated activities, such as in the vicinity of outposts in-space, on the Moon or on Mars.
Author
Space Communication; Design Optimization

20040086782 NASA Glenn Research Center, Cleveland, OH, USA
Notch Antennas
Lee, Richard Q.; July 2004; 30 pp.; In English
Report No.(s): NASA/TM-2004-213057; E-14503; No Copyright; Avail: CASI; A03, Hardcopy

Notch antennas, also known as the tapered slot antenna (TSA), have been the topics of research for decades. TSA has demonstrated multi-octave bandwidth, moderate gain (7 to 10 dB), and symmetric E- and H- plane beam patterns and can be used for many different applications. This chapter summarizes the research activities on notch antennas over the past decade with emphasis on their most recent advances and applications. This chapter begins with some discussions on the designs of single TSA; then follows with detailed discussions of issues associated with TSA designs and performance characteristics. To

conclude the chapter, some recent developments in TSA arrays and their applications are highlighted.
Author
Slot Antennas; Antenna Arrays; Antenna Design; Beams (Radiation)

20040087229 NASA Ames Research Center, Moffett Field, CA, USA
Introduction to Satellite Communications Technology for NREN
Stone, Thom; April 02, 2004; 8 pp.; In English
Contract(s)/Grant(s): NAS2-98080; No Copyright; Avail: CASI; A02, Hardcopy

NREN requirements for development of seamless nomadic networks necessitates that NREN staff have a working knowledge of basic satellite technology. This paper addresses the components required for a satellite-based communications system, applications, technology trends, orbits, and spectrum, and hopefully will afford the reader an end-to-end picture of this important technology.
Author (revised)
Satellite Communication; Communication Satellites

20040087304 Stanford Linear Accelerator Center, Stanford, CA, USA, Fermi National Accelerator Lab., Batavia, IL, USA
Internet Monitoring in the HEP Community
Matthews, W.; Cottrell, L.; Martin, D.; 1998; In English
Report No.(s): DE2004-9930; SLAC-PUB-7961; No Copyright; Avail: National Technical Information Service (NTIS)

The HEP Internet Monitoring Project (known as PingER) attempts to measure the performance of the Internet used by the High Energy Physics Research community and provide an accurate measurement of the end-to-end performance individuals may expect by monitoring the performance between a given monitoring node and remote node pair. This is achieved by monitoring the packet loss and round trip time (RTT) of ICMP Ping packets from 17 monitoring sites around the world to 373 nodes at 267 sites between 1084 monitoring-host-remote-site pairs, involving 27 countries. This paper details the current work and status of this on-going project. The architecture, methodology and nature of the problem will be reviewed, some trends will be discussed, and the direction of further work will be outlined.
NTIS
Computer Networks; High Energy Interactions; Energy Technology

20040087318 General Accounting Office, Washington, DC
Homeland Security: Federal Leadership and Intergovernmental Cooperation Required to Achieve First Responder Interoperable Communications
Jul. 2004; 104 pp.; In English
Report No.(s): PB2004-106184; GAO-04-740; No Copyright; Avail: CASI; A06, Hardcopy

Lives of first responders and those whom they are trying to assist can be lost when first responders cannot communicate effectively as needed. This report addresses issues of determining the status of interoperable wireless communications across the nation, and the potential roles that federal, state, and local governments can play in improving these communications. GAO recommends that the Secretary of DHS (1) continue to develop a nationwide database and common terminology for public safety interoperability communications channels; (2) assess interoperability in specific locations against defined requirements; (3) through federal grant awards, encourage state action to establish and support a statewide body to develop and implement detailed improvement plans; and (4) encourage that grant applications be in compliance with statewide interoperability plans, once they are developed. GAO also recommends that the Director of OMB work with DHS to review SAFECOM's functions and establish a long-term program with appropriate authority and funding to coordinate interoperability efforts across the federal government. DHS generally agreed with our first two recommendations but did not specifically address the other recommendations to DHS. OMB had no comments.
NTIS
Telecommunication; Channels (Data Transmission); Wireless Communication

Includes development, performance, and maintainability of electrical/electronic devices and components; related test equipment; and microelectronics and integrated circuitry. for related information see also *60 Computer Operations and Hardware*; and *76 Solid-State Physics*. For communications equipment and devices see *32 Communications and Radar*.

20040086111 Space and Naval Warfare Systems Center, San Diego, CA
TST Reconfigurable Aperture RF MEMS for Antenna Applications
Jacobs, E. W.; Simonds, H. B.; Roberts, M. W.; Jones, T. O., III; Brock, D. W.; Feb. 2004; 68 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424407; SSC/SD-TR-1910; No Copyright; Avail: CASI; A04, Hardcopy

This report documents the progress of the Tactical SIGINT Technology (TST) program in investigating radio- frequency (RF) microelectromechanical system (MEMS) pulsed RF performance, and application of these devices to signal intelligence (SIGINT) reconfigurable antennas.
DTIC
Apertures; Electromagnetic Interference; Microelectromechanical Systems; Radio Frequencies

20040086133 Rockwell Scientific Co., LLC, Thousand Oaks, CA
Incorporation of Amorphous Metals into MEMS for High Performance and Reliability
Porter, John R.; DeNatale, Jeffrey; Gluck, Natalie; Branagan, Daniel; Nov. 2003; 41 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-01-C-0084
Report No.(s): AD-A424455; GO-71189; ARO-42873.1-MS; No Copyright; Avail: CASI; A03, Hardcopy

Amorphous or amorphous derived metals have properties that can be very different from their crystalline counterparts. Since mechanisms for crystalline slip are absent, they can have high hardness and strength and exhibit high elastic strain before failure. Increasing the elastic limit of a component metal has the potential to enable the redesign of MEMS components to achieve higher performance for a given size device. To exploit these properties, Rockwell Scientific teamed with INEEL to develop the MEMS process flow to incorporate amorphous metals into MEMS devices. This report summarizes the results of a program to investigate one amorphous metal for MEMS insertion. The technologies developed in this program include: 1. Successful preparation of deposition targets by thermal spraying at INEEL. 2. Successful deposition of uniform coatings of amorphous alloy on silicon substrates by both laser ablation and sputtering. 3. Successful processing of MEMS test structures incorporating amorphous metals demonstrating. Only one amorphous alloy has been investigated and other amorphous alloys may prove more suitable for specific applications. Issues such as residual stress control, material property optimization and property characterization remain in need of further work.
DTIC
Amorphous Materials; Metals; Microelectromechanical Systems; Reliability

20040086152 Massachusetts Inst. of Tech., Cambridge, MA
The Effects of Mechanical Coupling on the Electrical Impedance of MEMS resonators for UHF Filter Applications
Hohreiter, Luke A.; May 7, 2004; 139 pp.; In English
Report No.(s): AD-A424489; AFIT-CI-04-434; No Copyright; Avail: CASI; A07, Hardcopy

This thesis presents finite elements based simulations of electromechanical transfer functions for resonator and filter geometries. These Finite Element Analysis (FEA) simulations are performed using the ANSYS software and demonstrate the significance of mechanical coupling between MEMS longitudinal-mode bar (L-Bar) resonators. An analytical model and equivalent circuit are derived for a single L-Bar resonator. The analytical derivation is validated with an PEA model having the same material parameters and boundary conditions. The center frequency and resonant impedance produced by the FEA model are within 1% of the analytical values. A boundary condition study is undertaken to determine the sensitivity of the L-Bar resonator model to changes in the peripheral geometry and displacement constraints. A comparison of FEA results indicates that a simple resonator model with only tether supports yields impedance and center frequency values comparable to those of more complex geometries. When compared to initial experimental results from an actual resonator, the simulated electrical output corresponds well to the actual transfer function. This study also introduces a method for calculating the parameters of the resonator's equivalent circuit model from simulated (or measured) transfer function data. The method is tested on simulation data for which a mechanical Quality factor is designated. Comparing the prescribed mechanical Q to the extracted circuit Q provides a consistency check for the technique. The parameter extraction technique is a useful first attempt

to devise a comprehensive method for determining circuit parameters that will reliably reproduce the transfer function of an actual resonator. Finally, a new resonator topology is presented that employs mechanical coupling between L-Bar resonators to improve upon the output of a single bar and create alternative configurations for filter design at Draper. The new coupled bar geometry can be
DTIC
Couplings; Electrical Impedance; Microelectromechanical Systems; Resonators; Ultrahigh Frequencies

20040086155 Pennsylvania State Univ., University Park, PA
Simultaneous Vibration Isolation and Damping Control Via High Authority Smart Structures
Wang, Kon-Well; Jan. 2000; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-00-1-0462
Report No.(s): AD-A424492; ARO-40281.3-EG; No Copyright; Avail: CASI; A03, Hardcopy

The goal of this proposed research is to investigate a new class of high authority smart structures to isolate vibration (isolate main structure from disturbance source) and control vibration (of the sub-structure with disturbance source) simultaneously in a multi-mode environment. The idea is to develop novel multi-loop piezoelectric networks and control schemes for multi-frequency, and varying- frequency disturbance absorptions and isolations. During this research period, the PI and his students have achieved the following: (a) Developed active-passive piezoelectric network systems and controller for vibration isolation/absorption of excitations with varying frequency; (b) Developed a multi-loop active-passive piezoelectric network isolator/absorber for multiple varying frequency disturbance rejections; (c) Performed single actuator experimental investigation and parametric study; and (d) Explored multiple actuator systems on complex structures. The analytical and experimental results have demonstrated that the proposed systems can outperform the current approaches and effectively achieve significant vibration absorption and isolation.
DTIC
Damping; Isolation; Smart Structures; Vibration; Vibration Isolators

20040086158 Titan Systems Corp., San Leandro, CA
The Breakdown Fields and Risetimes of Select Gases Under Conditions of Fast Charging (^20 ns and Less) and High Pressures (20-100 Atmospheres)
Carboni, Vic; Nov. 2001; 104 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F29601-99-C-0165; Proj-3005
Report No.(s): AD-A424499; AFRL-DE-TR-2001-1077; No Copyright; Avail: CASI; A06, Hardcopy

An interest in wideband impulse-radiating systems has brought about the need to develop high-voltage timed-array antennas that can focus and steer an electromagnetic pulse in the far field. To produce desirable radiated signal levels in the far field these arrays will need to be driven by high- voltage high-power sources that at least in the short term will have to rely on pulsers based on gas spark gap technology. To produce the high frequencies an array must be driven by sources with risetimes in the range of lOO-200 ps or even faster Since multiple pulsers will have to be used to drive a large array a suitable pulser design will most importantly have to have ultra-low triggering jitter (the standard deviation in the switch closure delay after trigger arrival). The jitter will have to be some relatively small fraction of this risetime to accurately steer and preserve the risetime.
DTIC
Electromagnetic Pulses; Gas Dissociation; High Pressure

20040086172 Pro-Tech, Alamo, CA
Design, Fabrication and Testing of a Timed-Array of TEM Horns for Beam Steering
Giri, Dave V.; Nov. 2001; 101 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F29601-99-C-0165; Proj-3005
Report No.(s): AD-A424547; AFRL-DE-TR-2001-1085; No Copyright; Avail: CASI; A06, Hardcopy

The objective of this study is to demonstrate one- dimensional steerability of a linear array of TEM horn antennas using the the true-time delay approach. Three TEM horns have been fabricated and tested in an array configuration. Initially the boresight radiation of a single TEM horn is measured at low-voltages and seem to be in agreement with theoretical models To demonstrate the linearity limited measurements were also performed using a 300 k V pulser with a single antenna completely immersed in oil.
DTIC
Beam Steering; Fabrication; Horn Antennas

20040086195 Arizona State Univ., Tempe, AZ

Synthesis of Superhard Thin Films and Coatings Based on Light Elements

Kouvetakis, J.; Tsong, I. S.; Apr. 18, 2004; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-00-10471

Report No.(s): AD-A424596; ARO-41552.8-MS; No Copyright; Avail: CASI; A02, Hardcopy

Superhard dielectric and optoelectronic materials in the Si-C-Al-N Si-B-O-N and Zr-B/Ga-N systems were prepared as thin films via novel CVD and MBE routes. SiC and AlN, normally insoluble in each other below 2000 deg C are combined to form single phase SiCAlN by gas source MBE of SiH3CN and Al atoms at 75000. The growth of epitaxial material takes place on 6H SiC and Si(111). Commensurate heteroepitaxy between Si(111) and SiCAIN is facilitated by the presence of a crystalline (Si-O-Al-N) oxide at the Si interface. The bandgap of SiCAlN is 3.2 eV and average hardness is 25 Gpa. Superhard metal borides such as ZrB2 and ternary analogs have been grown as perfectly epitaxial layers on Si(111). These materials in turn are used as totally reflective and lattice-matched buffer layers for integration of light emitting nitrides (GaN and AlGaN) with Si. UHV-CVD growth of single-phase Ge(1-x-y)Si(x) SN(y) semiconductors is conducted for the first time on Si(1OO). These materials exhibit tunable band gaps and possess lattice constants above and below that of Ge. The fabrication of Ge(1-x-y)Si(x) Sn(y) makes it possible to decouple strain and band gap engineering to achieve unique structures that lead to novel photonic devices based entirely on group IV materials (covering a wide range of operating wavelengths in the IR). Growth of random Ge(1-x)Sn(x) alloys and related ordered structures has been achieved directly on Si(100). Optical characterizations show a Ge like band structure. The band gaps and critical point energies are reduced monotonically with Sn content indicating that band gap engineering has been obtained in this system.

DTIC

Germanium Alloys; Infrared Radiation; Light Elements; Optical Materials; Semiconductors (Materials); Thin Films

20040086236 Naval Postgraduate School, Monterey, CA

Hardware-in-the-Loop Control of a Cascaded Multi- Level Converter

Barlow, Jacob L.; Jun. 2004; 83 pp.; In English; Original contains color illustrations

Report No.(s): AD-A424669; No Copyright; Avail: CASI; A05, Hardcopy

Next-generation U.S. Navy destroyers, known as DD(X), will use electric drive motors to meet their propulsion needs instead of the traditional mechanical drives. The use of electric drive motors in naval vessels has spurred the development of high power converters. This thesis examines the feasibility of using an advanced control algorithm known as Sine-triangle Pulse Width Modulation (SPWM) in combination with a Cascaded Multi-Level Converter (CMLC) in order to meet the U.S. Navy's strict requirements. The SPWM control algorithm was designed in Simulink and experimentally tested on a CMLC previously constructed at the Naval Postgraduate School. The controller and converter successfully powered a quarter horsepower three-phase induction motor.

DTIC

20040086248 Naval Postgraduate School, Monterey, CA

Real-Time Data Acquisition and Processing of the Magnetic, Angular Rate and Gravity (MARG) Sensor

Saliaris, Ioannis R.; Jun. 2004; 84 pp.; In English; Original contains color illustrations

Report No.(s): AD-A424695; No Copyright; Avail: CASI; A05, Hardcopy

This research involves the development of a human- body motion tracking system constructed with the use of commercial off-the-shelf (COTS) components. The problem to be solved is that the data from the motion tracking sensors must be transmitted wirelessly in real time from a microcontroller to a server computer. Due to the fact that the microcontroller does not support a standard OS widely used PCMCIA cards or USB wireless modules cannot be used. The wireless communication module chosen for this purpose is the DPAC airborne a highly integrated 802.11b module that can be easily integrated with the microcontroller. The evaluation of the module was completed in four stages. The first part was to initiate communication with the DPAC module. The second part was to establish communication between the DPAC module and a TCP server. The third part was to establish communication between the microcontroller and the DPAC module. The fourth part was to increase the baud-rate to the desired high value of 230,400 bps. The evaluation result indicates that the DPAC airborne module meets the wireless communication requirements of the motion tracking system.

DTIC

Angular Velocity; Data Acquisition; Data Processing; Gravitation; Modules; Real Time Operation

20040086600 Queens Univ., Belfast, UK

Nano-Photonics for Novel Photon Correlation Technologies

Brown, Robert G. W.; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 4; In English; See also 20040086587; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Recent experimental realization of a variety of nano-photonic and nano-electronic components creates many possibilities for new technologies that might be used in photon correlation and scattering experiments. The laser source can be shrunk to a nano-wire p-n junction, emitting from the UV to near-IR, yet output powers of mW levels can be obtained. The optics can be shrunk into nano-structured photonic-band-gap optical fibers, capable of being constructed to operate with single-mode performance from the UV to the near-IR - and with expanded single-mode volume to yield real flexibility in optical design and power handling. Like the laser, the detector can be shrunk to a nano-wire p-n junction to detect single-photons (or more) with remarkably little noise. Already one can start to imagine complete photon-correlation opto-electronic structures about the same size as the macromolecules they are to be used to observe, perhaps even embedded in the solutions under study? But perhaps the most intriguing aspect of the current nano-technology revolution is the impact it might have on photon-correlation processing electronics. We already have various nano-transistors, even single-electron nano-transistors operating at room temperature. Nano-memory storage elements of a variety of structures have been demonstrated recently. The electronic elements of a traditional design of photon-correlator could be transformed in the near future. Even more intriguing is that the basic structure of the photon-correlator itself might be altered radically by the availability of nano-electronic structures such as carbon nanotubes (CNTs). XOR functions and quantum computing architectures using CNTs have already been experimentally demonstrated. In the very near future they might be configured to provide novel photon-correlation capabilities with extraordinary computing speeds, in remarkably small volumes. This lecture - partly review - partly novel experimental design - will address all the above topics and attempt to point the way to some novel and advantageous photon-correlation technology possibilities we might realise during the next few years.

Derived from text

Photonics; Photons; Electronic Structure; Scattering; Laser Applications; Optical Equipment

20040086605 Case Western Reserve Univ., Cleveland, OH, USA

A Near-field Microwave Microscope and Electron Spin Resonance Detection

Mann, J. Adin, Jr.; Tabib-Azar, Massood; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 43-45; In English; See also 20040086587; No Copyright; Avail: CASI; A01, Hardcopy

Microwave photons can image a surface using near-field geometry. Spatial resolution is on the nanometer length scale. Moreover, it is possible to detect electron spin resonance splitting caused by a small permanent magnet positioned close to the surface containing a free radical moiety.

Author

Electron Paramagnetic Resonance; Spatial Resolution; Near Fields; Microwaves; Photons

20040086624 NASA Marshall Space Flight Center, Huntsville, AL, USA

Magnetic and Langmuir Probe Measurements on the Plasmoid Thruster Experiment (PTX)

Koelfgen, Syri J.; Eskridge, Richard; Lee, Michael H.; Martin, Adam; Hawk, Clark W.; Fimognan, Peter; [2004]; 11 pp.; In English; Joint Propulsion Conference, 11-14 Jul. 2004, Fort Lauderdale, FL, USA; Copyright; Avail: CASI; A03, Hardcopy

The Plasmoid Thruster Experiment (PTX) operates by inductively producing plasmoids in a conical theta-pinch coil and ejecting them at high velocity. A plasmoid is a plasma with an imbedded closed magnetic field structure. The shape and magnetic field structure of the translating plasmoids have been measured with of an array of magnetic field probes. Six sets of two B-dot probes were constructed for measuring B(sub z) and B(sub theta), the axial and azimuthal components of the magnetic field. The probes are wound on a square G10 form, and have an average (calibrated) NA of 9.37 x l0(exp -5) square meters, where N is the number of turns and A is the cross-sectional area. The probes were calibrated with a Helmholtz coil, driven by a high-voltage pulser to measure NA, and by a signal generator to determine the probe's frequency response. The plasmoid electron number density n(sub e) electron temperature T(sub e), and velocity ratio v/c(sub m), (where v is the bulk plasma flow velocity and c(sub m), is the ion thermal speed) have also been measured with a quadruple Langmuir probe. The Langmuir probe tips are 10 mm long, 20-mil diameter stainless steel wire, housed in a 6-inch long 4-bore aluminum rod. Measurements on PTX with argon and hydrogen from the magnetic field probes and quadruple Langmuir probe will be presented in this paper.

Author

Magnetic Probes; Plasmas (Physics); Magnetic Fields; Electrostatic Probes; Magnetic Measurement

20040086641 National Inst. of Standards and Technology, Gaithersburg, MD
Semiconductor Microelectronics and Nanoelectronics Programs, July 2004
Knight, S.; Martinez de Pinillos, J. V.; Buckley, M.; Jul. 2004; In English
Report No.(s): PB2004-106434; NISTIR-7121; No Copyright; Avail: National Technical Information Service (NTIS)

The microelectronics industry supplies vital components to the electronics industry and to the U. S. economy, enabling rapid improvements to productivity and in new high technology growth industries such as electronic commerce and biotechnology. The National Institute of Standards and Technology, NIST, in fulfilling its mission of strengthening the U.S. economy, works with industry to develop and apply technology, measurements and standards; and applies substantial efforts on behalf of the semiconductor industry and its infrastructure. This report describes the many projects being conducted at NIST that constitute that effort.
NTIS
Electronic Commerce; Electronic Equipment; Productivity

20040086658 NASA Langley Research Center, Hampton, VA, USA
An Investigation of EME as a Potential Cause of Fuel Tank Ignition
Ely, Jay J.; Nguyen, Truong X.; Dudley, Kenneth L.; Scearce, Stephen A.; Beck, Fred B.; Deshpande, Manohar D.; Cockrell, C. R.; January 2004; 10 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

NASA researchers were tasked to study the potential for radio signals to excite an aircraft fuel quantity indication system (FQIS) enough to cause arcing, sparking or excessive heating within a fuel tank. Computational techniques were used to determine the threat from external high intensity radiated field (HIRF) transmitters nearby, like shipboard and airborne RADAR systems. Experimental methods were used to determine the threat from Portable Electronic Devices (PEDs) carried aboard by passengers. To support this work, unique electromagnetic coupling measurements were performed on a retired Boeing 747 aircraft, and new test and analysis methods were developed that may be applied to other FQIS designs as well as other aircraft electronic systems.
Author
Fuel Tanks; Ignition; Aircraft Fuel Systems; Electromagnetism; Air Transportation

20040086676 NASA Langley Research Center, Hampton, VA, USA
Electromagnetic Detection of Fatigue Cracks under Protruding Head Ferromagnetic Fasteners
Wincheski, Buzz; Namkung, Min; [2004]; 9 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

The detection of fatigue cracks under installed fasteners has been a major goal of the aging aircraft NDE community. The Sliding Probe, Magneto-Optic Imager, Rotating Self-Nulling Probe, Low Frequency Eddy Current Array, and Eddyscan systems are among the instruments developed for this inspection. It has been verified that the detection of fatigue cracks under flush head aluminum and titanium fasteners can be accomplished with a high resolution by the above techniques. The detection of fatigue cracks under ferromagnetic and protruding head fasteners, however, has been found to be much more difficult. For the present work, the inspection for fatigue cracks under SAE 4340 Steel Hi-Lok fasteners is explored. Modifications to the Rotating Self-Nulling Eddy Current Probe System are presented which enable the detection of fatigue cracks hidden under the protruding head of the ferromagnetic fastener. Inspection results for samples with varying length EDM notches are shown, as well as a comparison between the signature from an EDM notch and an actual fatigue crack. Finite Element Modeling is used to investigate the effect of the ferromagnetic fastener on the induced eddy current distribution in order to help explain the detection characteristics of the system. This paper will also introduce a modification to the Rotating Probe System designed specifically for the detection of deeply buried flaws in multilayer conductors. The design change incorporates a giant magnetoresistive (GMR) sensor as the pickup device to improve the low frequency performance of the probe. The flaw detection capabilities of the GMR based Self- Nulling Probe are presented along with the status of the GMR based Rotating Probe System for detection of deeply buried flaws under installed fasteners.
Author
Defects; Detection; Magnetoresistivity; Nondestructive Tests

20040095335 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Design and Performance of a Miniature Radar L-Band Transceiver
McWatters, D.; Price, D.; Edelstein, W.; Interplanetary Network Progress Report; August 15, 2004; Volume 42-158, pp. 1-13; In English; No Copyright; Avail: CASI; A03, Hardcopy

Radar electronics developed for past JPL space missions historically had been custom designed and as such, given

budgetary, time, and risk constraints, had not been optimized for maximum flexibility or miniaturization. To help reduce cost and risk of future radar missions, a generic radar module was conceived. The module includes a 1.25-GHz (L-band) transceiver and incorporates miniature high-density packaging of integrated circuits in die/chip form. The technology challenges include overcoming the effect of miniaturization and high packaging density to achieve the performance, reliability, and environmental ruggedness required for space missions. The module was chosen to have representative (generic) functionality most likely required from an L-band radar. For very large aperture phased-array spaceborne radar missions, the large dimensions of the array suggest the benefit of distributing the radar electronics into the antenna array. For such applications, this technology is essential in order to bring down the cost, mass, and power of the radar electronics module replicated in each panel of the array. For smaller sized arrays, a single module can be combined with the central radar controller and still provide the bene.ts of configuration .exibility, low power, and low mass. We present the design approach for the radar electronics module and the test results for its radio frequency (RF) portion: a miniature, low-power, radiation-hard L-band transceiver.
Author
Miniaturization; Transmitter Receivers; Ultrahigh Frequencies; Electronics; Radar Transmission; Mechanical Engineering

34
FLUID MECHANICS AND THERMODYNAMICS

Includes fluid dynamics and kinematics and all forms of heat transfer; boundary layer flow; hydrodynamics; hydraulics; fluidics; mass transfer and ablation cooling. For related information see also *02 Aerodynamics*.

20040086204 Naval Postgraduate School, Monterey, CA
Evaluation and Analysis of DDG-81 Simulated Athwartship Shock Response
Petrusa, Douglas C.; Jun. 2004; 90 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424618; No Copyright; Avail: CASI; A05, Hardcopy

In 2001 the USS WINSTON CHURCHILL (DDG-81) was subjected to three underwater explosions as part of a ship shock trial. Using the actual trial data front experiment and three-dimensional dynamic models of the ship and surrounding fluid very successful comparisons of the vertical motion have been achieved. On average, the magnified of the vertical motion is three to four times the magnitude of athwartship motion. Previous simulations of this athwartship motion have been less accurate than the vertical motion simulations. This thesis examines recent efforts attempted to improve the simulation results of the athwartship motion including shock spectra analysis, and the reasons behind the disparities that exist between the simulated values and the actual trial data.
DTIC
Ships; Shock Spectra; Underwater Explosions

20040086252 Washington Univ., Seattle, WA
A Comprehensive Study of Vortex Breakdown Flow Mechanisms: Computational Investigation and Preliminary Control
Johnson, William F., III; Mar. 15, 2004; 170 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424701; No Copyright; Avail: CASI; A08, Hardcopy

A modified vortex filament method is used to simulate the evolution of the transient formation of vortex breakdown. The method supports previous studies, illustrating that vortex breakdown. The method supports previous studies, illustrating that vortex breakdown is initiated by a negative vorticity gradient which triggers an inviscid self-induction feedback mechanism and when subsequently subjected to viscous effects, results in steady state vortex breakdown. The results of the method are first validated experimentally with numerous past dye flow visualization and particle image velocimetry investigations, and then used to qualitatively investigate the self-induction flow mechanisms during the formative stages of stages of transient breakdown. As a complement to the qualitative investigation, a quantitative analysis is performed, which yields a local and dynamical relationship relating the azimuthal vorticity gradient at a particular location to the curvature of the instantaneous streamline, projected onto the meridional plane, at the same location. This relationship further shows that once radial expansion commences in the region of negative azimuthal vorticity, it continues to expand such that the meridional streamline becomes more curved with time, supporting that the negative vorticity gradient not only initiates the radial expansion, but also, feeds its subsequent growth. On the contrary, in the region of a positive gradient, the streamline continues to flatten fostering radial contraction of the vortex tube, which provides a closure to expansion. In attempt to suppress breakdown in two preliminary control simulations, this positive azimuthal vorticity gradient is then introduced to the vortex flow just prior to

breakdown. Results from these control simulations illustrated a temporal and spatial delay in breakdown as well as exhibiting flow behavior associated with complete elimination of breakdown.
DTIC
Flow Visualization; Vortex Breakdown; Vortices

20040086549 North Carolina State Univ., Raleigh, NC, USA
Algorithmic Enhancements for the VULCAN Navier-Stokes Solver
Edwards, Jack R.; [2004]; 4 pp.; In English
Contract(s)/Grant(s): NAG1-2216; No Copyright; Avail: CASI; A01, Hardcopy

Work performed over the last three years has resulted in the addition of several new algorithms to the VULCAN code, NASA's standard for Navier-Stokes calculations in high-speed aeropropulsion devices. This final report describes the new techniques in brief and presents sample results from their use.
Derived from text
Algorithms; Navier-Stokes Equation; Computer Programs; Multigrid Methods

20040086562 NASA Langley Research Center, Hampton, VA, USA
A Resonant Pulse Detonation Actuator for High-Speed Boundary Layer Separation Control
Beck, B. T.; Cutler, A. D.; Drummond, J. P.; Jones, S. B.; January 2004; 14 pp.; In English; 11th International Symposium on Flow Visualization, 9-12 Aug. 2004, Notre Dame, IN, USA
Contract(s)/Grant(s): 762-55-MB
Report No.(s): 2004-11ISV-BTB; No Copyright; Avail: CASI; A03, Hardcopy

A variety of different types of actuators have been previously investigated as flow control devices. Potential applications include the control of boundary layer separation in external flows, as well as jet engine inlet and diffuser flow control. The operating principles for such devices are typically based on either mechanical deflection of control surfaces (which include MEMS flap devices), mass injection (which includes combustion driven jet actuators), or through the use of synthetic jets (diaphragm devices which produce a pulsating jet with no net mass flow). This paper introduces some of the initial flow visualization work related to the development of a relatively new type of combustion-driven jet actuator that has been proposed based on a pulse detonation principle. The device is designed to utilize localized detonation of a premixed fuel (Hydrogen)-air mixture to periodically inject a jet of gas transversely into the primary flow. Initial testing with airflow successfully demonstrated resonant conditions within the range of acoustic frequencies expected for the design. Schlieren visualization of the pulsating air jet structure revealed axially symmetric vortex flow, along with the formation of shocks. Flow visualization of the first successful sustained oscillation condition is also demonstrated for one configuration of the current test section. Future testing will explore in more detail the onset of resonant combustion and the approach to conditions of sustained resonant detonation.
Author
Actuators; Boundary Layer Separation; High Speed; Pulse Detonation Engines; Flow Visualization

20040086594 Harvard Univ., MA, USA
Scattering Probes of the Growth and Elasticity of Colloidal Gels
Weitz, David A.; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 26; In English; See also 20040086587; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Dynamic light scattering is used to determine the elasticity of colloidal gels. Comparison of microgravity and earth based data suggest new aging mechanisms. The gelation process can exhibit hallmarks of the glass transition.
Author
Probes; Light Scattering; Gelation; Colloids

20040086601 Ecole Normale Superieure, Paris, France
Avalanche Behavior in Yield Stress Fluids
Bonn, Daniel; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 7; In English; See also 20040086587; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We show that above a critical stress, typical yield stress fluids (gels, clay suspensions) and soft glassy materials (the colloidal glass of Laponite) start flowing abruptly and subsequently accelerate, leading to avalanches that are remarkably similar to those of granular materials. Rheometrical tests reveal that this is associated to a bifurcation in rheological behavior:

for small stresses, the viscosity increases in time: the material ‘ages", and eventually stops flowing. For slightly larger stresses the viscosity decreases continuously in time: the flow accelerates and we observe a ‘rejuvenation’ of the material by the flow. We show that for the Laponite system, both the aging and the shear rejuvenation can be observed directly using Photon Correlation Spectroscopy and Diffusive Wave Spectroscopy. We propose a simple physical model capable of reproducing the rheological observations.
Author
Avalanches; Fluid Flow; Yield; Viscosity

20040086603 Istituto Nazionale per la Fisica della Materia, Milan, Italy
Shadowgraphic Study of Convection Onset in a Colloidal Suspension
Cerbino, R.; Mazzoni, S.; Vailati, A.; Giglio, M.; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 9-10; In English; See also 20040086587; No Copyright; Avail: CASI; A01, Hardcopy

A shadowgraph optical setup is used to study the time evolution of Soret induced convection in a colloidal suspension. We obtain a scale invariant behavior for the solutal Nusselt number as a function of the Rayleigh number. In a typical Rayleigh-Benard experiment a horizontal slab of a fluid is contained between a top and bottom plates maintained at two different temperatures (higher temperature at the bottom plate). The order parameter of the system is the Rayleigh number R(alpha) and when R(alpha) exceeds 1708 the configuration becomes gravitationally unstable and a macroscopic convective flow takes place inside the enclosure: the warm fluid near the bottom plate rises toward the top plate, where eventually cools and begins to sink back to the warm bottom plate. When the temperature difference between the plates becomes large, the process becomes boundary layer dominated. As soon as the temperature difference is applied two thin conductive boundary layers grow near the isothermal plates until they are eventually destabilized by ascending and descending thermal plumes. For low values of the Prandtl number Pr = nu/k (the ratio of the momentum diffusivity over the temperature one) the transition to turbulence takes place for Rayleigh numbers of the order of 10(exp 5). This is due to the relatively high value of the thermal diffusivity . that favors a chaotic diffusive mixing of plumes. On the contrary, for high values of Pr, a plume can cross the entire layer height without being distorted in shape by heat diffusion and the transition to turbulence takes place at much higher Rayleigh numbers. One of the most interesting information in convecting systems is given by the Nusselt number Nu: the enhancement of the heat flux beyond the conductive value due to convection across the layer. For high Rayleigh numbers (R(alpha) greater than 10(exp 7)) it is expected a scaling law in the form: Nu proportional to R(alpha)(sup p) the numerical value for the exponent p depending on Pr. Boundary layer convection takes also place in binary mixtures at large Rayleigh numbers, where the concentration differences induced by the Soret effect play the same role of temperature ones. The sudden imposition of a temperature gradient between the plates induces a steady mass flow by means of the Soret effect. Near one impermeable plate mass starts gathering (and getting depleted near the opposite one) and two thin concentration boundary layers are instantaneously formed. Again the boundary layers are rapidly destabilized by concentration plumes. A formal analogy between thermal and solutal convection has been proved providing the mapping of the relevant parameters into equivalent ones with concentration playing the role of temperature: the usual (thermal) Rayleigh number and Prandtl numbers are mirrored by the solutal Rayleigh number R(alpha) and the Schmidt number Sc = nu/D (the ratio of the momentum diffusivity over the concentration one). In this work we present experimental results on the transient regime of a Soret driven boundary layer convective instability at high solutal Rayleigh numbers. The sample is a diluted aqueous colloidal suspension of silica spheres with an unusually large negative Soret coefficient S(sub T). The mass diffusion coefficient D is so low is so low that the mixture has a virtually infinite Schmidt number. The experiment is conducted by heating from above so to be sure that the traditional Rayleigh-Benard instability is not possible, and very high solutal Rayleigh numbers can be easily reached. The study is conducted by using a quantitative Shadowgraph technique to visualize directly the pattern of solutal refractive index modulations in the cell without renouncing to characterize the convective flow within the cell. The root mean square of the shadowgraph intensity signal gives an information equivalent to the turbidity of usual light scattering experiments. In such a way it is possible to estimate the amplitude of the coective flow as a function of time.
Author
Shadowgraph Photography; Convective Flow; Colloids; Suspending (Mixing); Time Dependence

20040086604 Utrecht Univ., Utrecht, Netherlands
Reentrant Melting of Colloidal Hard Spheres Near a Wall
Dullens, Roel P. A.; Kegel, Willem K.; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 11; In English; See also 20040086587; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Concentrated suspensions of colloidal hard spheres near a hard wall were studied in real space by means of time-resolved confocal scanning laser microscopy. Both structure and dynamics of these systems are dramatically different from their bulk

analogues (i.e., far away from a wall). In particular, systems that are a glass (a solid phase without long-range positional order) in the bulk show significant hexagonal order near a wall. The hexagonal order is observed to first increase with volume fraction of the colloids, reach a constant value and subsequently decrease. When hexagonal order decreases, the mobility of the particles starts increasing with volume fraction. These observations are consistent with a reentrant melting transition. However, the behavior of static correlation functions indicate that the in-plane structure near a wall is hexatic rather than crystalline, reflecting the two dimensional character of dense matter near walls.
Author
Walls; Colloids; Concentration (Composition); Solid Phases

20040086614 Malvern Instruments Ltd., Malvern, UK
Effect of Electrolyte Concentration on the Hydrodynamic Radius of Polymer Lattices as Measured With PCS
Rega, Carlos A.; Jack, Robert O.; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 18; In English; See also 20040086587; No Copyright; Avail: CASI; A01, Hardcopy

In this paper we study the effect of electrolyte concentration on the hydrodynamic radius of polymer latex particles using PCS. Our measurements show that the concentration of electrolyte on the surface charge of the particles has a significant effect on the particle size as measured using PCS.
Author
Electrolytes; Concentration (Composition); Hydrodynamics

20040086617 National Center for Microgravity Research on Fluids and Combusiton, Cleveland, OH, USA
Surface Response Functions for a Thin-Film Between Fluids with Infinite Boundaries and for a Fluid-Fluid Interface Between Finite Boundaries
Meyer, William V.; Mann, J. Adin, Jr.; Wegdam, Gerard H.; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 54-56; In English; See also 20040086587; No Copyright; Avail: CASI; A01, Hardcopy

A simplified surface response function is presented for interfaces with a thin film between two fluids of infinite extent; and the newly derived results for the surface response function of a fluid-fluid interface between finite boundaries is presented. The previously published solution [1] of the surface response function (SRF) for the interfaces of a thinfilm between two fluids of infinite extent has been further simplified and shown to reduce to the simple fluid-fluid interface solution when the film thickness goes to zero. This mathematical reduction of several hundred pages to a single page of equation components will be published in the full paper. This abstract, due to space limitations, presents the resulting 3-D parametric plot in Figure 1 of the power spectra that result from the surface response function that is plotted as a function of film thickness and frequency. For the conference presentation, a movie showing how this 3-D plot changes for different scattering angles, q, will be presented. This new SRF solution is now simple enough that a fast computer can use it to fit actual surface light scattering data, such as that which we have presented elsewhere [1 - 3]. This empirical data looks visually akin to the theory plots combined in Figure 1. When using the full thin-film SRF presented here for analyzing surface light scattering data (along with the instrument function we provide elsewhere [1, 3]), surface properties such as surface tension and viscosity are now directly manifested. And when solving the SRF; one no longer has to ask which root of the dispersion equation provides the correct answer. These solutions, which include both the normal and tangential interface components, work for underdamped, critically damped and overdamped systems. These developments can be used to characterize systems with liquid vapor and liquid liquid interfaces including spreading monolayers, whenever optical access for a laser beam is available.
Author
Thin Films; Surface Properties; Liquid-Liquid Interfaces; Interfacial Tension

20040086685 Combustion Research and Flow Technology, Inc., Pipersville, PA, USA
Simulations of Cavitating Cryogenic Inducers
Dorney, Dan, Technical Monitor; Hosangadi, Ashvin; Ahuja, Vineet; Ungewitter, Ronald J.; July 2004; 11 pp.; In English; 40th AIAA/ASME/SAE/ASEE Joint Propulsion Conference, 11-14 Jul. 2004, Fort Lauderdale, FL, USA
Contract(s)/Grant(s): NAS8-02098
Report No.(s): AIAA Paper 2004-4023; No Copyright; Avail: CASI; A03, Hardcopy

Simulations of cavitating turbopump inducers at their design flow rate are presented. Results over a broad range of Nss, numbers extending from single-phase flow conditions through the critical head break down point are discussed. The flow characteristics and performance of a subscale geometry designed for water testing are compared with the fullscale configuration that employs LOX. In particular, thermal depression effects arising from cavitation in cryogenic fluids are

identified and their impact on the suction performance of the inducer quantified. The simulations have been performed using the CRUNCH CFD[R] code that has a generalized multi-element unstructured framework suitable for turbomachinery applications. An advanced multi-phase formulation for cryogenic fluids that models temperature depression and real fluid property variations is employed. The formulation has been extensively validated for both liquid nitrogen and liquid hydrogen by simulating the experiments of Hord on hydrofoils; excellent estimates of the leading edge temperature and pressure depression were obtained while the comparisons in the cavity closure region were reasonable.
Author
Cavitation Flow; Cryogenic Fluids; Simulation; Temperature Effects; Turbomachinery; Flow Characteristics; Flow Velocity; Turbine Pumps

20040086701 Army Research Lab., Hampton, VA, USA
Coupled Thermo-Mechanical Analyses of Dynamically Loaded Rubber Cylinders
Johnson, Arthur R.; Chen, Tzi-Kang; [2000]; 12 pp.; In English; 32nd International SAMPE Technical Conference, 5-9 Nov. 2000, Boston, MA, USA; No Copyright; Avail: CASI; A03, Hardcopy

A procedure that models coupled thermo-mechanical deformations of viscoelastic rubber cylinders by employing the ABAQUS finite element code is described. Computational simulations of hysteretic heating are presented for several tall and short rubber cylinders both with and without a steel disk at their centers. The cylinders are compressed axially and are then cyclically loaded about the compressed state. The non-uniform hysteretic heating of the rubber cylinders containing a steel disk is presented. The analyses performed suggest that the coupling procedure should be considered for further development as a design tool for rubber degradation studies.
Author
Finite Element Method; Thermodynamics; Viscoelastic Cylinders; Structural Analysis; Thermal Analysis; Thermoviscoelasticity; Rubber

20040086725 Rensselaer Polytechnic Inst., Troy, NY, USA
Research in Support of the Use of Rankine Cycle Energy Conversion Systems for Space Power and Propulsion
Lahey, Richard T., Jr.; Dhir, Vijay; July 2004; 25 pp.; In English
Contract(s)/Grant(s): NCC3-975; WBS 101-43-10
Report No.(s): NASA/CR-2004-213142; E-14657; No Copyright; Avail: CASI; A03, Hardcopy

This is the report of a Scientific Working Group (SWG) formed by NASA to determine the feasibility of using a liquid metal cooled nuclear reactor and Rankine energy conversion cycle for dual purpose power and propulsion in space. This is a high level technical report which is intended for use by NASA management in program planning. The SWG was composed of a team of specialists in nuclear energy and multiphase flow and heat transfer technology from academia, national laboratories, NASA and industry. The SWG has identified the key technology issues that need to be addressed and have recommended an integrated short term (approx. 2 years) and a long term (approx. 10 year) research and development (R&D) program to qualify a Rankine cycle power plant for use in space. This research is ultimately intended to give NASA and its contractors the ability to reliably predict both steady and transient multiphase flow and heat transfer phenomena at reduced gravity, so they can analyze and optimize designs and scale-up experimental data on Rankine cycle components and systems. In addition, some of these results should also be useful for the analysis and design of various multiphase life support and thermal management systems being considered by NASA.
Author
Multiphase Flow; Nuclear Reactors; Propulsion; Rankine Cycle; Liquid Metal Cooled Reactors; NASA Programs; Heat Transfer; Microgravity

20040086748 NASA Langley Research Center, Hampton, VA, USA
Solving Navier-Stokes Equations with Advanced Turbulence Models on Three-Dimensional Unstructured Grids
Wang, Qun-Zhen; Massey, Steven J.; Abdol-Hamid, Khaled S.; Frink, Neal T.; [1999]; 10 pp.; In English; 37th AIAA Aerospace Sciences Meeting and Exhibit, 11-14 Jan. 1999, Reno, NV, USA
Report No.(s): AIAA Paper 99-0156; Copyright; Avail: CASI; A02, Hardcopy

USM3D is a widely-used unstructured flow solver for simulating inviscid and viscous flows over complex geometries. The current version (version 5.0) of USM3D, however, does not have advanced turbulence models to accurately simulate complicated flows. We have implemented two modified versions of the original Jones and Launder k-epsilon two-equation turbulence model and the Girimaji algebraic Reynolds stress model in USM3D. Tests have been conducted for two flat plate

boundary layer cases, a RAE2822 airfoil and an ONERA M6 wing. The results are compared with those of empirical formulae, theoretical results and the existing Spalart-Allmaras one-equation model.
Author
Turbulence Models; Unstructured Grids (Mathematics); Three Dimensional Flow; Navier-Stokes Equation; Computational Fluid Dynamics

20040086753 NASA Langley Research Center, Hampton, VA, USA
Unstructured Grid Generation for Complex 3D High-Lift Configurations
Pirzadeh, Shahyar Z.; [1999]; 9 pp.; In English
Report No.(s): Rept-1999-01-5557; No Copyright; Avail: CASI; A02, Hardcopy

The application of an unstructured grid methodology on a three-dimensional high-lift configuration is presented. The focus of this paper is on the grid generation aspect of an integrated effort for the development of an unstructured-grid computational fluid dynamics (CFD) capability at the NASA Langley Research Center. The meshing approach is based on tetrahedral grids generated by the advancing-front and the advancing-layers procedures. The capability of the method for solving high-lift problems is demonstrated on an aircraft model referred to as the energy efficient transport configuration. The grid generation issues, including the pros and cons of the present approach, are discussed in relation to the high-lift problems. Limited viscous flow results are presented to demonstrate the viability of the generated grids. A corresponding Navier-Stokes solution capability, along with further computations on the present grid, is presented in a companion SAE paper.
Author
Aerodynamic Configurations; Aircraft Models; Computational Fluid Dynamics; Grid Generation (Mathematics); Unstructured Grids (Mathematics); Lift; Three Dimensional Models

20040086807 NASA Langley Research Center, Hampton, VA, USA
Reduced-Order Models Based on Linear and Nonlinear Aerodynamic Impulse Responses
Silva, Walter A.; [1999]; 12 pp.; In English; AIAA/ASME/ASCE/AHS/ASC, 12-15 Apr. 1999, Saint Louis, MO, USA
Report No.(s): AIAA Paper 99-1262; Copyright; Avail: CASI; A03, Hardcopy

This paper discusses a method for the identification and application of reduced-order models based on linear and nonlinear aerodynamic impulse responses. The Volterra theory of nonlinear systems and an appropriate kernel identification technique are described. Insight into the nature of kernels is provided by applying the method to the nonlinear Riccati equation in a non-aerodynamic application. The method is then applied to a nonlinear aerodynamic model of RAE 2822 supercritical airfoil undergoing plunge motions using the CFL3D Navier-Stokes flow solver with the Spalart-Allmaras turbulence model. Results demonstrate the computational efficiency of the technique.
Author
Mathematical Models; Computational Fluid Dynamics; Nonlinear Systems; Impulses; Aerodynamic Characteristics

20040086812 NASA Langley Research Center, Hampton, VA, USA
Pulse Phase Thermography for Defect Detection and Visualization
Marinetti, Sergio; Plotnikov, Yuri A.; Winfree, William P.; Braggiotti, Alberto; [1999]; 9 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

Pulse Phase Thermography (PPT) has been reported as a novel powerful technique of the thermal NDE. It employs application of the Discrete Fourier Transform (DFT) to thermal images obtained following flash heating of the front surface of a specimen. The computed phasegrams are excellent for defect visualization in a wide range of materials. This is in part due to their low sensitivity to uneven heating. This work is an attempt to analyze advantages and limitations of PPT. Results of application of the DFT to simulated temperature decays are presented. The temperature evolution on a surface has been simulated based on an analytical solution of the one-dimensional heat diffusion problem. A more sophisticated study has been done for different sizes of defects using numerical solution of the three-dimensional mathematical model. Capabilities of PPT for in-depth scanning and for monitoring of the material loss are discussed. The recommendations for the practical application of the PPT are presented. Experimental results obtained following these recommendations are reported.
Author
Thermography; Fourier Transformation; Phase Contrast; Image Processing

20040086834 NASA Langley Research Center, Hampton, VA, USA

Large-Scale Parallel Unstructured Mesh Computations for 3D High-Lift Analysis

Mavriplis, D. J.; Pirzadeh, S.; [1999]; 15 pp.; In English; 37th AIAA Aerospace Sciences Meeting, 11-14 Jan. 19999, Reno, NV, USA

Report No.(s): AIAA Paper 99-0537; Copyright; Avail: CASI; A03, Hardcopy

A complete 'geometry to drag-polar' analysis capability for three-dimensional high-lift configurations is described. The approach is based on the use of unstructured meshes in order to enable rapid turnaround for complicated geometries which arise in high-lift con gurations. Special attention is devoted to creating a capability for enabling analyses on highly resolved grids. Unstructured meshes of several million vertices are initially generated on a work-station, and subsequently refined on a supercomputer. The flow is solved on these refined meshes on large parallel computers using an unstructured agglomeration multigrid algorithm. Good prediction of lift and drag throughout the range of incidences is demonstrated on a transport take-off configuration using up to 24.7 million grid points. The feasibility of using this approach in a production environment on existing parallel machines is demonstrated, as well as the scalability of the solver on machines using up to 1450 processors.

Author

Aerodynamic Configurations; Lift; Unstructured Grids (Mathematics); Grid Generation (Mathematics); Parallel Computers; Three Dimensional Flow; Algorithms

20040086851 NASA Langley Research Center, Hampton, VA, USA

Efficient Multi-Stage Time Marching for Viscous Flows via Local Preconditioning

Kleb, William L.; Wood, William A.; vanLeer, Bram; [1999]; 15 pp.; In English; 14th AIAA CFD Conference, 28 Jun. - 1 Jul. 1999, Norfolk, VA, USA

Report No.(s): AIAA Paper 99-3267; Copyright; Avail: CASI; A03, Hardcopy

A new method has been developed to accelerate the convergence of explicit time-marching, laminar, Navier-Stokes codes through the combination of local preconditioning and multi-stage time marching optimization. Local preconditioning is a technique to modify the time-dependent equations so that all information moves or decays at nearly the same rate, thus relieving the stiffness for a system of equations. Multi-stage time marching can be optimized by modifying its coefficients to account for the presence of viscous terms, allowing larger time steps. We show it is possible to optimize the time marching scheme for a wide range of cell Reynolds numbers for the scalar advection-diffusion equation, and local preconditioning allows this optimization to be applied to the Navier-Stokes equations. Convergence acceleration of the new method is demonstrated through numerical experiments with circular advection and laminar boundary-layer flow over a flat plate.

Author

Boundary Layer Flow; Flow Equations; Laminar Boundary Layer; Navier-Stokes Equation; Time Marching; Viscous Flow

20040086853 NASA Langley Research Center, Hampton, VA, USA

Parametric Weight Comparison of Current and Proposed Thermal Protection System (TPS) Concepts

Myers, David E.; Martin, Carl J.; Blosser, Max L.; [1999]; 12 pp.; In English; 33rd Thermophysics Conference, 28 Jun. - 1 Jul. 1999, Norfolk, VA, USA

Report No.(s): AIAA Paper 99-3459; Copyright; Avail: CASI; A03, Hardcopy

A parametric weight assessment of advanced metallic panel, ceramic blanket, and ceramic tile thermal protection systems (TPS) was conducted using an implicit, one-dimensional (1 -D) thermal finite element sizing code. This sizing code contained models to ac- count for coatings, fasteners, adhesives, and strain isolation pads. Atmospheric entry heating profiles for two vehicles, the Access to Space (ATS) rocket-powered single-stage-to-orbit (SSTO) vehicle and a proposed Reusable Launch Vehicle (RLV), were used to ensure that the trends were not unique to a particular trajectory. Eight TPS concepts were compared for a range of applied heat loads and substructural heat capacities to identify general trends. This study found the blanket TPS concepts have the lightest weights over the majority of their applicable ranges, and current technology ceramic tiles and metallic TPS concepts have similar weights. A proposed, state-of-the-art metallic system which uses a higher temperature alloy and efficient multilayer insulation was predicted to be significantly lighter than the ceramic tile systems and approaches blanket TPS weights for higher integrated heat loads.

Author

Parameterization; Thermal Protection; Currents

20040086858 NASA Langley Research Center, Hampton, VA, USA
X-33 Hypersonic Boundary Layer Transition
Berry, Scott A.; Horvath, Thomas J.; Hollis, Brian R.; Thompson, Richard A.; Hamilton, H. Harris, II; [1999]; 16 pp.; In English; 33rd AIAA Thermophysics Conference, 28 Jun. - 1 Jul. 1999, Norfolk, VA, USA
Report No.(s): AIAA Paper 99-3560; Copyright; Avail: CASI; A03, Hardcopy

Boundary layer and aeroheating characteristics of several X-33 configurations have been experimentally examined in the Langley 20-Inch Mach 6 Air Tunnel. Global surface heat transfer distributions, surface streamline patterns, and shock shapes were measured on 0.013-scale models at Mach 6 in air. Parametric variations include angles-of-attack of 20-deg, 30-deg, and 40-deg; Reynolds numbers based on model length of 0.9 to 6.6 million; and body-flap deflections of 0, 10 and 20-deg. The effects of discrete and distributed roughness elements on boundary layer transition, which included trip height, size, location, and distribution, both on and off the windward centerline, were investigated. The discrete roughness results on centerline were used to provide a transition correlation for the X-33 flight vehicle that was applicable across the range of reentry angles of attack. The attachment line discrete roughness results were shown to be consistent with the centerline results, as no increased sensitivity to roughness along the attachment line was identified. The effect of bowed panels was qualitatively shown to be less effective than the discrete trips; however, the distributed nature of the bowed panels affected a larger percent of the aft-body windward surface than a single discrete trip.
Author
Aerodynamic Heating; Boundary Layer Transition; Hypersonic Boundary Layer; X-33 Reusable Launch Vehicle

20040086965 NASA Langley Research Center, Hampton, VA, USA
DSMC Simulation of Shock/Shock Interactions: Emphasis on Type IV Interactions
Moss, J. N.; Pot, T.; Chanetz, B.; Lefebvre, M.; [1999]; 6 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

This paper presents the results of a numerical study of shock/shock interactions that include both the Edney type IV and type III interactions, with emphasis on the type IV interactions. Computations are made using the direct simulation Monte Carlo (DSMC) method of Bird for Mach 10 air flow, as produced in the ONERA R5Ch low-density wind tunnel. The simulations include the flow about a shock generator which creates a relatively weak oblique shock that impinges on a much stronger cylinder bow shock. The sensitivity and characteristics of the interactions are examined by varying the horizontal distance separating the shock generator leading edge and cylinder. Results of the simulation for one separation distance are compared with wind tunnel measurements. Comparisons are made for surface heating and pressure and for flow-field values of density and rotational temperatures, as obtained with the Dual-line Coherent Anti-Stokes Scattering (DL-CARS) technique. The comparisons between experiment and calculation yield a consistent description of the shock interaction features and a consistent description of the surface heating and pressure distributions, with the exception of the peak values-the computed values being greater than the measured values.
Author
Bow Waves; Hypersonic Speed; Low Density Wind Tunnels; Monte Carlo Method; Shock Wave Interaction; Wind Tunnel Tests; Numerical Analysis

20040087236 NASA Langley Research Center, Hampton, VA, USA
Numerical and Analytical Solutions of Hypersonic Interactions Involving Surface Property Discontinuities
Gnoffo, Peter A.; Inger, George R.; [1999]; 11 pp.; In English
Report No.(s): AIAA Paper 99-4836; Copyright; Avail: CASI; A03, Hardcopy

The local viscous-inviscid interaction field generated by a wall temperature jump on a flat plate in supersonic flow and on the windside of a Reusable Launch Vehicle in hypersonic flow is studied in detail by both a Navier-Stokes numerical code and an analytical triple-deck model. Treatment of the rapid heat transfer changes both upstream and downstream of the jump is included. Closed form relationships derived from the triple-deck theory are presented. The analytically predicted pressure and heating variations including upstream influence are found to be in generally good agreement with the Computational Fluid Dynamic (CFD) predictions. These analyses not only clarify the interactive physics involved but also are useful in preliminary design of thermal protection systems and as an insertable module to improve CFD code efficiency when applied to such small-scale interaction problems. The analyses only require conditions at the wall and boundary-layer edge which are easily extracted from a baseline, constant wall temperature, CFD solution.
Author
Hypersonic Flow; Surface Temperature; Catalytic Activity; Supersonic Flow

20040087251 James Madison Univ., Harrisonburg, VA, USA

Temporal Large-Eddy Simulation

Pruett, C. D.; Thomas, B. C.; July 31, 2004; 83 pp.; In English

Contract(s)/Grant(s): NAG1-02033; No Copyright; Avail: CASI; A05, Hardcopy

In 1999, Stolz and Adams unveiled a subgrid-scale model for LES based upon approximately inverting (defiltering) the spatial grid-filter operator and termed .the approximate deconvolution model (ADM). Subsequently, the utility and accuracy of the ADM were demonstrated in a posteriori analyses of flows as diverse as incompressible plane-channel flow and supersonic compression-ramp flow. In a prelude to the current paper, a parameterized temporal ADM (TADM) was developed and demonstrated in both a priori and a posteriori analyses for forced, viscous Burger's flow. The development of a time-filtered variant of the ADM was motivated-primarily by the desire for a unifying theoretical and computational context to encompass direct numerical simulation (DNS), large-eddy simulation (LES), and Reynolds averaged Navier-Stokes simulation (RANS). The resultant methodology was termed temporal LES (TLES). To permit exploration of the parameter space, however, previous analyses of the TADM were restricted to Burger's flow, and it has remained to demonstrate the TADM and TLES methodology for three-dimensional flow. For several reasons, plane-channel flow presents an ideal test case for the TADM. Among these reasons, channel flow is anisotropic, yet it lends itself to highly efficient and accurate spectral numerical methods. Moreover, channel-flow has been investigated extensively by DNS, and a highly accurate data base of Moser et.al. exists. In the present paper, we develop a fully anisotropic TADM model and demonstrate its utility in simulating incompressible plane-channel flow at nominal values of Re(sub tau) = 180 and Re(sub tau) = 590 by the TLES method. The TADM model is shown to perform nearly as well as the ADM at equivalent resolution, thereby establishing TLES as a viable alternative to LES. Moreover, as the current model is suboptimal is some respects, there is considerable room to improve TLES.

Author

Large Eddy Simulation; Numerical Analysis; Viscous Flow; Scale Models; Reynolds Averaging; Direct Numerical Simulation

20040087269 NASA Langley Research Center, Hampton, VA, USA

Reduction and Analysis of Phosphor Thermography Data With the IHEAT Software Package

Merski, N. Ronald; [1998]; 21 pp.; In English; 36th AIAA Aerospace Sciences Meeting and Exhibit, 12-15 Jan. 1998, Reno, NV, USA

Report No.(s): AIAA Paper 98-0712; Copyright; Avail: CASI; A03, Hardcopy

Detailed aeroheating information is critical to the successful design of a thermal protection system (TPS) for an aerospace vehicle. This report describes NASA Langley Research Center's (LaRC) two-color relative-intensity phosphor thermography method and the IHEAT software package which is used for the efficient data reduction and analysis of the phosphor image data. Development of theory is provided for a new weighted two-color relative-intensity fluorescence theory for quantitatively determining surface temperatures on hypersonic wind tunnel models; an improved application of the one-dimensional conduction theory for use in determining global heating mappings; and extrapolation of wind tunnel data to flight surface temperatures. The phosphor methodology at LaRC is presented including descriptions of phosphor model fabrication, test facilities and phosphor video acquisition systems. A discussion of the calibration procedures, data reduction and data analysis is given. Estimates of the total uncertainties (with a 95% confidence level) associated with the phosphor technique are shown to be approximately 8 to 10 percent in the Langley's 31-Inch Mach 10 Tunnel and 7 to 10 percent in the 20-Inch Mach 6 Tunnel. A comparison with thin-film measurements using two-inch radius hemispheres shows the phosphor data to be within 7 percent of thin-film measurements and to agree even better with predictions via a LATCH computational fluid dynamics solution (CFD). Good agreement between phosphor data and LAURA CFD computations on the forebody of a vertical takeoff/vertical lander configuration at four angles of attack is also shown. In addition, a comparison is given between Mach 6 phosphor data and laminar and turbulent solutions generated using the LAURA, GASP and LATCH CFD codes. Finally, the extrapolation method developed in this report is applied to the X-34 configuration with good agreement between the phosphor extrapolation and LAURA flight surface temperature predictions. The phosphor process outlined in the paper is believed to provide the aerothermodynamic community with a valuable capability for rapidly obtaining (4 to 5 weeks) detailed heating information needed in TPS design.

Author

Phosphors; Thermography; Computer Programs; Aerospace Vehicles; Aerothermodynamics; Computational Fluid Dynamics; Wind Tunnel Models; Aerodynamic Configurations; Data Reduction

20040088542 NASA Langley Research Center, Hampton, VA, USA
Langley Aerothermodynamic Facilities Complex: Enhancements and Testing Capabilities
Micol, J. R.; [1998]; 28 pp.; In English; 36th AIAA Aerospace Sciences Meeting and Exhibit, 12-15 Jan. 1998, Reno, NV, USA
Report No.(s): AIAA Paper 98-0147; Copyright; Avail: CASI; A03, Hardcopy

Description, capabilities, recent upgrades, and utilization of the NASA Langley Research Center (LaRC) Aerothermodynamic Facilities Complex (AFC) are presented. The AFC consists of five hypersonic, blow-down-to-vacuum wind tunnels that collectively provide a range of Mach number from 6 to 20, unit Reynolds number from 0.04 to 22 million per foot and, most importantly for blunt configurations, normal shock density ratio from 4 to 12. These wide ranges of hypersonic simulation parameters are due, in part, to the use of three different test gases (air, helium, and tetrafluoromethane), thereby making several of the facilities unique. The Complex represents nearly three-fourths of the conventional (as opposed to impulse)-type hypersonic wind tunnels operational in this country. AFC facilities are used to assess and optimize the hypersonic aerodynamic performance and aeroheating characteristics of aerospace vehicle concepts and to provide benchmark aerodynamic/aeroheating data fr generating the flight aerodynamic databook and final design of the thermal protection system (TPS) (e.g., establishment of flight limitations not to exceed TPS design limits). Modifications and enhancements of AFC hardware components and instrumentation have been pursued to increase capability, reliability, and productivity in support of programmatic goals. Examples illustrating facility utilization in recent years to generate essentially all of the experimental hypersonic aerodynamic and aeroheating information for high-priority, fast-paced Agency programs are presented. These programs include Phase I of the Reusable Launch Vehicle (RLV) Advanced Technology Demonstrator, X-33 program, PHase II of the X-33 program, X-34 program, the Hyper-X program (a Mach 5,7, and 10 airbreathing propulsion flight experiment), and the X-38 program (Experimental Crew Return Vehicle, X-CRV). Current upgrades/enchancements and future plans for the AFC are discussed.
Author
Aerothermodynamics; Reusable Launch Vehicles; Technology Utilization; NASA Programs; Wind Tunnel Tests; Hypersonic Wind Tunnels; Computational Fluid Dynamics

20040090468 Eloret Corp., Moffett Field, CA, USA, NASA Ames Research Center, Moffett Field, CA, USA
Characterization of the Space Shuttle Ascent Debris using CFD Methods
Murman, Scott M.; Aftosmis, Michael J.; Rogers, Stuart E.; [2005]; 13 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA
Contract(s)/Grant(s): 704-40-21; No Copyright; Avail: CASI; A03, Hardcopy

After video analysis of space shuttle flight STS-107's ascent showed that an object shed from the bipod-ramp region impacted the left wing, a transport analysis was initiated to determine a credible flight path and impact velocity for the piece of debris. This debris transport analysis was performed both during orbit, and after the subsequent re-entry accident. The analysis provided an accurate prediction of the velocity a large piece of foam bipod ramp would have as it impacted the wing leading edge. This prediction was corroborated by video analysis and fully-coupled CFD/six degree of freedom (DOF) simulations. While the prediction of impact velocity was accurate enough to predict critical damage in this case, one of the recommendations of the Columbia Accident Investigation Board (CAIB) for return-to-flight (RTF) was to analyze the complete debris environment experienced by the shuttle stack on ascent. This includes categorizing all possible debris sources, their probable geometric and aerodynamic characteristics, and their potential for damage. This paper is chiefly concerned with predicting the aerodynamic characteristics of a variety of potential debris sources (insulating foam and cork, nose-cone ablator, ice, ...) for the shuttle ascent configuration using CFD methods. These aerodynamic characteristics are used in the debris transport analysis to predict flight path, impact velocity and angle, and provide statistical variation to perform risk analyses where appropriate. The debris aerodynamic characteristics are difficult to determine using traditional methods, such as static or dynamic test data, due to the scaling requirements of simulating a typical debris event. The use of CFD methods has been a critical element for building confidence in the accuracy of the debris transport code by bridging the gap between existing aerodynamic data and the dynamics of full-scale, in-flight events.
Author
Computational Fluid Dynamics; Transport Theory; Debris

20040090500 NASA Langley Research Center, Hampton, VA, USA
Heavy Gas Conversion of the NASA Langley Transonic Dynamics Tunnel
Corliss, James M.; Cole, Stanley, R.; [1998]; 11 pp.; In English; 20th AIAA Advanced Measurement and Ground Testing Technology Conference, 15-18 Jun. 1998, Albuquerque, NM, USA
Report No.(s): AIAA Paper 98-2710; Copyright; Avail: CASI; A03, Hardcopy

The heavy gas test medium has recently been changed in the Transonic Dynamics Tunnel (TDT) at the NASA Langley Research Center. A NASA Construction of Facilities project has converted the TDT heavy gas from dichlorodifluoromethane (R12) to 1,1,1,2 tetrafluoroethane (R134a). The facility s heavy gas processing system was extensively modified to implement the conversion to R134a. Additional system modifications have improved operator interfaces, hardware reliability, and quality of the research data. The facility modifications included improvements to the heavy gas compressor and piping, the cryogenic heavy gas reclamation system, and the heavy gas control room. A series of wind tunnel characterization and calibration tests are underway. Results of the flow characterization tests show the TDT operating envelope in R134a to be very similar to the previous operating envelope in R12.
Author
Gases; Transonic Wind Tunnels; Ground Based Control; Wind Tunnel Calibration

20040090508 NASA Langley Research Center, Hampton, VA, USA
Prediction of Very High Reynolds Number Compressible Skin Friction
Carlson, John R.; [1998]; 16 pp.; In English
Report No.(s): AIAA Paper 98-2880; Copyright; Avail: CASI; A03, Hardcopy

Flat plate skin friction calculations over a range of Mach numbers from 0.4 to 3.5 at Reynolds numbers from 16 million to 492 million using a Navier Stokes method with advanced turbulence modeling are compared with incompressible skin friction coefficient correlations. The semi-empirical correlation theories of van Driest; Cope; Winkler and Cha; and Sommer and Short T' are used to transform the predicted skin friction coefficients of solutions using two algebraic Reynolds stress turbulence models in the Navier-Stokes method PAB3D. In general, the predicted skin friction coefficients scaled well with each reference temperature theory though, overall the theory by Sommer and Short appeared to best collapse the predicted coefficients. At the lower Reynolds number 3 to 30 million, both the Girimaji and Shih, Zhu and Lumley turbulence models predicted skin-friction coefficients within 2% of the semi-empirical correlation skin friction coefficients. At the higher Reynolds numbers of 100 to 500 million, the turbulence models by Shih, Zhu and Lumley and Girimaji predicted coefficients that were 6% less and 10% greater, respectively, than the semi-empirical coefficients.
Author
High Reynolds Number; Skin Friction; Compressible Flow; Simulation; Turbulence Models; Computational Fluid Dynamics

20040090510 NASA Langley Research Center, Hampton, VA, USA
The Use of Heavy Gas for Increased Reynolds Numbers in Transonic Wind Tunnels
Anders, J. B.; Anderson, W. K.; Murthy, A. V.; [1998]; 10 pp.; In English; 20th AIAA Advanced Measurement and Ground Testing Technology Conference, 15-18 Jun. 1998, Albuquerque, NN, USA
Report No.(s): AIAA Paper 98-2882; Copyright; Avail: CASI; A02, Hardcopy

The use of a high molecular weight test gas to increase the Reynolds number range of transonic wind tunnels is explored. Modifications to a small transonic wind tunnel are described and the real gas properties of the example heavy gas (sulfur hexafluoride) are discussed. Sulfur hexafluoride is shown to increase the test Reynolds number by a factor of more than 2 over air at the same Mach number. Experimental and computational pressure distributions on an advanced supercritical airfoil configuration at Mach 0.7 in both sulfur hexafluoride and nitrogen are presented. Transonic similarity theory is shown to be partially successful in transforming the heavy gas results to equivalent nitrogen (air) results, provided the correct definition of gamma is used.
Author
Reynolds Number; Transonic Wind Tunnels; Real Gases; Test Facilities; Cryogenics

20040090512 Lockheed Martin Engineering and Sciences Co., Hampton, VA, USA
Grid Generation Techniques Utilizing the Volume Grid Manipulator
Alter, Stephen J.; [1998]; 11 pp.; In English; 29th AIAA Fluid Dynamics Conference, 15-18 Jun. 1998, Albuquerque, NM, USA
Contract(s)/Grant(s): NAS1-96014
Report No.(s): AIAA Paper 98-3012; Copyright; Avail: CASI; A03, Hardcopy

This paper presents grid generation techniques available in the Volume Grid Manipulation (VGM) code. The VGM code is designed to manipulate existing line, surface and volume grids to improve the quality of the data. It embodies an easy to read rich language of commands that enables such alterations as topology changes, grid adaption and smoothing. Additionally, the VGM code can be used to construct simplified straight lines, splines, and conic sections which are common curves used

in the generation and manipulation of points, lines, surfaces and volumes (i.e., grid data). These simple geometric curves are essential in the construction of domain discretizations for computational fluid dynamic simulations. By comparison to previously established methods of generating these curves interactively, the VGM code provides control of slope continuity and grid point-to-point stretchings as well as quick changes in the controlling parameters. The VGM code offers the capability to couple the generation of these geometries with an extensive manipulation methodology in a scripting language. The scripting language allows parametric studies of a vehicle geometry to be efficiently performed to evaluate favorable trends in the design process. As examples of the powerful capabilities of the VGM code, a wake flow field domain will be appended to an existing X33 Venturestar volume grid; negative volumes resulting from grid expansions to enable flow field capture on a simple geometry, will be corrected; and geometrical changes to a vehicle component of the X33 Venturestar will be shown.
Author

Computational Fluid Dynamics; Grid Generation (Mathematics); Topology; Computer Programs

20040090513 NASA Langley Research Center, Hampton, VA, USA

Experimental, Theoretical, and Computational Investigation of Separated Nozzle Flows

[1998]; 21 pp.; In English; 34th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 13-15 Jul. 1998, Cleveland, OH, USA

Report No.(s): AIAA Paper 98-3107; Copyright; Avail: CASI; A03, Hardcopy

A detailed experimental, theoretical, and computational study of separated nozzle flows has been conducted. Experimental testing was performed at the NASA Langley 16-Foot Transonic Tunnel Complex. As part of a comprehensive static performance investigation, force, moment, and pressure measurements were made and schlieren flow visualization was obtained for a sub-scale, non-axisymmetric, two-dimensional, convergent- divergent nozzle. In addition, two-dimensional numerical simulations were run using the computational fluid dynamics code PAB3D with two-equation turbulence closure and algebraic Reynolds stress modeling. For reference, experimental and computational results were compared with theoretical predictions based on one-dimensional gas dynamics and an approximate integral momentum boundary layer method. Experimental results from this study indicate that off-design overexpanded nozzle flow was dominated by shock induced boundary layer separation, which was divided into two distinct flow regimes; three- dimensional separation with partial reattachment, and fully detached two-dimensional separation. The test nozzle was observed to go through a marked transition in passing from one regime to the other. In all cases, separation provided a significant increase in static thrust efficiency compared to the ideal prediction. Results indicate that with controlled separation, the entire overexpanded range of nozzle performance would be within 10% of the peak thrust efficiency. By offering savings in weight and complexity over a conventional mechanical exhaust system, this may allow a fixed geometry nozzle to cover an entire flight envelope. The computational simulation was in excellent agreement with experimental data over most of the test range, and did a good job of modeling internal flow and thrust performance. An exception occurred at low nozzle pressure ratios, where the two-dimensional computational model was inconsistent with the three-dimensional separation observed in the experiment. In general, the computation captured the physics of the shock boundary layer interaction and shock induced boundary layer separation in the nozzle, though there were some differences in shock structure compared to experiment. Though minor, these differences could be important for studies involving flow control or thrust vectoring of separated nozzles. Combined with other observations, this indicates that more detailed, three-dimensional computational modeling needs to be conducted to more realistically simulate shock-separated nozzle flows.
Author

Separated Flow; Nozzle Flow; Nozzle Design; Computational Fluid Dynamics; Mathematical Models; Transonic Wind Tunnels

20040090514 NASA Langley Research Center, Hampton, VA, USA

PAB3D Simulations of a Nozzle with Fluidic Injection for Yaw Thrust-Vector Control

Deere, Karen A.; [1998]; 12 pp.; In English; 34th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 13-15 Jul. 1998, Cleveland, OH, USA

Report No.(s): AIAA Paper 98-3254; Copyright; Avail: CASI; A03, Hardcopy

An experimental and computational study was conducted on an exhaust nozzle with fluidic injection for yaw thrust-vector control. The nozzle concept was tested experimentally in the NASA Langley Jet Exit Test Facility (JETF) at nozzle pressure ratios up to 4 and secondary fluidic injection flow rates up to 15 percent of the primary flow rate. Although many injection-port geometries and two nozzle planforms (symmetric and asymmetric) were tested experimentally, this paper focuses on the computational results of the more successful asymmetric planform with a slot injection port. This nozzle concept was simulated with the Navier-Stokes flow solver, PAB3D, invoking the Shih, Zhu, and Lumley algebraic Reynolds stress

turbulence model (ASM) at nozzle pressure ratios (NPRs) of 2,3, and 4 with secondary to primary injection flow rates (w(sub s)/w(sub p)) of 0, 2, 7 and 10 percent.
Author
Exhaust Nozzles; Test Facilities; Thrust Vector Control; Fluid Injection; Navier-Stokes Equation; Computational Fluid Dynamics; Computerized Simulation; Yaw

20040090527 NASA Langley Research Center, Hampton, VA, USA
Shock-Wave/Boundary-Layer Interactions in Hypersonic Low Density Flows
Moss, James N.; Olejniczak, Joseph; [2004]; 20 pp.; In English; 7th AIAA/ASME Joint Thermophysics and Heat Transfer Conference, 15-18 Jun. 1998, Albuquerque, NM, USA
Report No.(s): AIAA Paper 98-2668; Copyright; Avail: CASI; A03, Hardcopy

Results of numerical simulations of Mach 10 air flow over a hollow cylinder-flare and a double-cone are presented where viscous effects are significant. The flow phenomena include shock-shock and shock- boundary-layer interactions with accompanying flow separation, recirculation, and reattachment. The purpose of this study is to promote an understanding of the fundamental gas dynamics resulting from such complex interactions and to clarify the requirements for meaningful simulations of such flows when using the direct simulation Monte Carlo (DSMC) method. Particular emphasis is placed on the sensitivity of computed results to grid resolution. Comparisons of the DSMC results for the hollow cylinder-flare (30 deg.) configuration are made with the results of experimental measurements conducted in the ONERA RSCh wind tunnel for heating, pressure, and the extent of separation. Agreement between computations and measurements for various quantities is good except that for pressure. For the same flow conditions, the double- cone geometry (25 deg.- 65 deg.) produces much stronger interactions, and these interactions are investigated numerically using both DSMC and Navier-Stokes codes. For the double-cone computations, a two orders of magnitude variation in free-stream density (with Reynolds numbers from 247 to 24,7 19) is investigated using both computational methods. For this range of flow conditions, the computational results are in qualitative agreement for the extent of separation with the DSMC method always predicting a smaller separation region. Results from the Navier-Stokes calculations suggest that the flow for the highest density double-cone case may be unsteady; however, the DSMC solution does not show evidence of unsteadiness.
Author
Shock Wave Interaction; Boundary Layer Separation; Low Density Flow; Numerical Analysis; Air Flow; Cylindrical Bodies

20040095294 North Carolina State Univ., Raleigh, NC, USA
Modeling Turbulent Combustion for Variable Prandtl and Schmidt Number
Hassan, H. A.; January 2004; 15 pp.; In English
Contract(s)/Grant(s): NAG1-03030; No Copyright; Avail: CASI; A03, Hardcopy

This report consists of two abstracts submitted for possible presentation at the AIAA Aerospace Science Meeting to be held in January 2005. Since the submittal of these abstracts we are continuing refinement of the model coefficients derived for the case of a variable Turbulent Prandtl number. The test cases being investigated are a Mach 9.2 flow over a degree ramp and a Mach 8.2 3-D calculation of crossing shocks. We have developed an axisymmetric code for treating axisymmetric flows. In addition the variable Schmidt number formulation was incorporated in the code and we are in the process of determining the model constants.
Derived from text
Prandtl Number; Schmidt Number; Turbulent Combustion; Mathematical Models; Aerospace Sciences

20040095344 NASA Langley Research Center, Hampton, VA, USA
CFD Approaches for Simulation of Wing-Body Stage Separation
Buning, Pieter G.; Gomez, Reynaldo J.; Scallion, William I.; [2004]; 11 pp.; In English; 22nd AIAA Applied Aerodynamics Conference, 16-19 Aug. 2004, Providence, RI, USA
Contract(s)/Grant(s): 23-794-40-3E
Report No.(s): AIAA Paper 2004-4838; No Copyright; Avail: CASI; A03, Hardcopy

A collection of computational fluid dynamics tools and techniques are being developed and tested for application to stage separation and abort simulation for next-generation launch vehicles. In this work, an overset grid Navier-Stokes flow solver has been enhanced and demonstrated on a matrix of proximity cases and on a dynamic separation simulation of a belly-to-belly wing-body configuration. Steady cases show excellent agreement between Navier-Stokes results, Cartesian grid Euler solutions, and wind tunnel data at Mach 3. Good agreement has been obtained between Navier-Stokes, Euler, and wind tunnel

results at Mach 6. An analysis of a dynamic separation at Mach 3 demonstrates that unsteady aerodynamic effects are not important for this scenario. Results provide an illustration of the relative applicability of Euler and Navier-Stokes methods to these types of problems.
Author
Computational Fluid Dynamics; Stage Separation; Unsteady Aerodynamics; Wind Tunnel Tests; Computerized Simulation; Body-Wing Configurations

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INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography. For aerial photography see *43 Earth Resources and Remote Sensing*. For related information see also *06 Avionics and Aircraft Instrumentation*; and *19 Spacecraft Instrumentation and Astrionics*.

20040086125 Massachusetts Inst. of Tech., Lexington, MA
RCS Scatterer Extraction Using Apriori Target Information
Mayhan, J. T.; Mar. 23, 2004; 40 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F19628-00-C-0002
Report No.(s): AD-A424430; TR-1093; ESC-TR-2003-078; No Copyright; Avail: CASI; A03, Hardcopy

Target component feature extraction is an area of considerable importance to the Ballistic Missile Defense (BMD) community. In particular, extracting essential target features from measurement data on targets of interest leads to potential target identification. The extracted component features correspond to a numerical characterization of the Geometrical Theory of Diffraction (GTD) diffraction coefficient and can also be used to develop a computationally efficient, measurement based RCS signature prediction model. A key attribute of the resulting computational model is that the measured RCS is directly incorporated into the computational model. An essential ingredient in forming a measurements-based signature model valid over a wide range of frequencies and angles is the ability to map the field measurement data (2 dimensional) onto a component-based three-dimensional (3D) geometry. To accomplish this, 3D characterization of the target scattering components is required. Typically, this 3D characterization of the scatterer locations is obtained by forming a 3D image of the target, and extracting the dominant scattering centers. In this paper we extend the novel formulation for 3D radar imaging of Inverse Synthetic Aperture Radar (ISAR) sparse- angle data using high-resolution spectral estimation theory presented in a previous paper (Ref 1) to the special case where one has apriori information about the target geometry.
DTIC
Extraction; Radar Cross Sections; Scattering; Synthetic Aperture Radar; Target Recognition; Targets

20040086126 Marine Mammal Research Consultants Ltd., Honolulu, HI
Marine Mammal Aerial Surveys in Bahamas and Hawaii
Mobley, Joseph R., Jr; Dec. 2003; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-02-1-0841
Report No.(s): AD-A424433; No Copyright; Avail: CASI; A03, Hardcopy

Aerial surveys of marine mammals were performed as part of the Marine Mammal Monitoring on Navy Undersea Acoustic Ranges (3MR) program in three regions: a) Pacific Missile Range Facility (PMRF), Barking Sands, Kauai (BSURE and BARSTUR ranges; Jul 12-Nov 17, 2002); b) Bahamas (Northwest Providence Channel and AUTEC range; Jan 4-12, 2003); and c) main Hawaiian Islands (Feb 21-Apr 5, 2003). The mission was to identify species and record positions and composition of all marine mammal pods sighted. These data were made available to co- investigators (Martin and Moretti) of the 3MR program in order to correlate the visual positions with acoustic localizations using Navy assets.
DTIC
Animals; Bahamas; Marine Biology; Marine Mammals; Surveys

20040086199 Massachusetts Inst. of Tech., Cambridge, MA
Sub-100nm, Maskless Deep-UV Zone-Plate Array Lithography
Smith, Harry I.; May 7, 2004; 154 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-01-1-0330
Report No.(s): AD-A424607; ARO-42428.2-EL; No Copyright; Avail: CASI; A08, Hardcopy

Semiconductor lithography is at a crossroads. With mask set costs in excess of $1M, long mask-turn-around times, and

tools that are characterized by their inflexibility and skyrocketing costs (in excess of $20M), there is need for a new paradigm in lithography. Zone-Plate-Array Lithography (ZPAL) bypasses some of the most pressing problems of current lithography equipment by offering a maskless lithography tool that is scalable, flexible and low cost. It is the departure from a century-old tradition of refractive optics, in combination with the use of advanced micromechanics and fast computing, that enables ZPAL to open up a new application space in lithography. This report covers in detail all levels of the ZPAL system, from the micromechanics, to the diffractive optics, to the control system. Special emphasis is placed on the design, fabrication and characterization of high- numerical-aperture diffractive-optical elements for lithography and imaging. The results achieved provide conclusive evidence that diffractive optics in general, and zone plates in particular, are capable of state-of-the-art lithography and are extendable to the limits of the lithography process. As a result, ZPAL represents the most promising approach to low cost maskless lithography for the semiconductor industry and other areas of nanoscale science and engineering.
DTIC
Lithography; Semiconductors (Materials)

20040086206 Oregon State Univ., Corvallis, OR
The Influence of Bottom Morphology on Far Field Reflectance
Zaneveld, Ronald V.; Boss, Emmanuel S.; Jul. 14, 2004; 12 pp.; In English
Contract(s)/Grant(s): N00014-97-10011
Report No.(s): AD-A424626; N0088; No Copyright; Avail: CASI; A03, Hardcopy

We have carried out analyses of the CoBOP field data in order to meet the objectives regarding the use of measured IOP in the models, Results of the analysis have been published in the Limnology and Oceanography special issue (Boss and Zaneveld, 2002). This paper analyzes the distribution of IOP near the bottom and in the water column of a shallow reef and sand area at Lee Stocking, Bahamas. We have developed a preliminary theoretical model of the near and far field reflectance of a sinusoidal bottom as it relates to the reflectance of a flat bottom with the same material (material reflectance). This model has been published in the Limnology and Oceanography special issue (Zaneveld and Boss, 2002). We have carried out further numerical analyses of the near and far field reflectance of a sinusoidal bottom as it relates to the reflectance of a flat bottom with the same material (material reflectance). We have further carried models that include surface wave effects, in order to determine the influence of non-flat sea surfaces and ocean bottoms on the horizontal distribution of the internal radiance. This is important as classical radiative transfer assumes that radiance distributions are plane parallel, i.e. the same at a given depth in the ocean, A paper on this topic is in preparation.
DTIC
Far Fields; Morphology; Oceanographic Parameters; Reflectance

20040086232 Naval Research Lab., Washington, DC
ShipIR Model Validation Using NATO SIMVEX Experiment Results
Fraedrich, Doug; Miller, Craig; Stark, Espen; Heen, Lars T.; May 31, 2004; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424663; NRL/FR/5750--04-10080; No Copyright; Avail: CASI; A03, Hardcopy

An infrared (IR) field trial has been conducted by a NATO science panel on IR ship signatures, TG-16. This trial was planned, designed, and executed to validate predictive IR ship signature simulations. Details of the trial were dictated by a validation methodology that exploits the concept of experimental precision. Two government defense laboratories, the Norwegian Defence Research Establishment and the U.S. Naval Research Laboratory, have used these trial data to perform a validation analysis on the ShipIR IR signature code. This analysis quantifies prediction accuracy of the current versions of the code and identifies specific portions of the code that need to be upgraded to improve prediction accuracy.
DTIC
Infrared Signatures; North Atlantic Treaty Organization (NATO); Ships; Signatures

20040086234 Naval Postgraduate School, Monterey, CA
Design of a Bore Sight Camera for the Lineate Image Near Ultraviolet Spectrometer (LINUS)
Cabezas, Rodrigo; Jun. 2004; 79 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424667; No Copyright; Avail: CASI; A05, Hardcopy

The Lineate Image Near Ultraviolet Spectrometer (LINUS) is a spectral imager that works in the ultraviolet region of the spectrum. This thesis describes the latest of several steps in the development of this instrument. Due to the narrow field of

view of the instrument, 2.5 x 0.5 degrees, an accurate pointing method is necessary; also, a scheme of quality evaluation of the post-processed spectral image is desirable. A way to achieve both goals was developed by designing and implementing the layout for two visual cameras, wide and narrow field of view, and a method to capture the images in order to perform the subsequent comparison with the processed spectral image. Since this is the first time the system is working in full-automated mode, a new wavelength calibration with the emission lines from a platinum hollow cathode lamp was performed and a new response curve for sulfur dioxide (SO2) was taken. Finally, laboratory and outdoor field observations were conducted to test the system integration.
DTIC
Boresights; Cameras; Ultraviolet Spectrometers

20040086258 Naval Postgraduate School, Monterey, CA
Suitability of the SRC-6E Reconfigurable Computing System for Generating False Radar Images
Macklin, Kendrick R.; Jun. 2004; 149 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424711; No Copyright; Avail: CASI; A07, Hardcopy

This thesis evaluates the usefulness of the SRC-6E reconfigurable computing system, a particular kind of specialized computer, for the radar-signal processing application of generating false radar images. It documents the process of creating and importing VHDL code to configure the user definable logic on the SRC-6E, building on previous work for the SRC-6E. Data from alternative computational approaches to the same problem are compared to determine the effectiveness of a SRC-6E solution. The result show that the SRC-6E provides no advantage until the task is made significantly complex; for this application, this was at greater than 64 range bins. This supports the hypothesis that the algorithm requires too muon initialization effort to take much advantage of the parallel processing and pipelining of toe SRC-6E. An evaluation of the SRC-6E difficulty of use is conducted, including a discussion of required skills, experience and development times.
DTIC
Algorithms; Computers; Radar Imagery; Targets

20040086265 Naval Postgraduate School, Monterey, CA
Charge Transport Study of InGaAs Two-Color QWIPs
Hoang, Vu D.; Jun. 2004; 73 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424723; No Copyright; Avail: CASI; A04, Hardcopy

In this thesis, a series of experiments were performed to characterize the material properties of InGaAs/GaAs for use in a two-color quantum-well IR photodetector (QWIP) design. Results from room temperature studies using cathodoluminescence and photoluminescence indicated light emission at 858 nm and 1019 nm from GaAs and In-GaAs, respectively. Using a direct transport imaging technique, an edge dislocation pattern was observed and shown to be confined to the InGaAs layer of the material. A dislocation density measurement was performed and was shown to be less than 2000 lines/cm.
DTIC
Charge Transfer; Color; Indium Gallium Arsenides; Photometers

20040086277 Naval Postgraduate School, Monterey, CA
An Investigation of Surface Current Patterns Related to Upwelling in Monterey Bay, Using High Frequency Radar
Enriquez, Andres; Jun. 2004; 101 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424752; No Copyright; Avail: CASI; A06, Hardcopy

High Frequency (HF) radar backscatter instruments are under development and testing in the marine science and defense science communities for their abilities to remotely sense surface parameters in the coastal ocean over large areas. In the Navy context, the systems provide real-time mapping of ocean surface currents and waves critical to characterization and forecasting of the battlespace environment. In this study, HF radar, aircraft and satellite information were used to investigate and describe surface current in Monterey Bay, California, for a period of ten months, from June 1, 2003 to March 31, 2004. A network of five CODAR-type HF radar instruments measured hourly surface currents over the bay. The measurements were averaged over one-hour intervals and total surface velocities were mapped on a grid in the Monterey Bay. Major upwelling events were observed during the period of June 14 to June 27, July 4 to July 19, August 8 to August 18 and other upwelling events were observed until late October. These periods of upwelling favorable winds are common during summer with durations of 10 to 20 days. Cyclonic circulation cells are developed on shore during upwelling conditions and an anticyclonic circulation in the middle of the bay is observed when the wind shifts to the southwest producing a strong flow out of the bay close to the

coastline off Point Pi os. Downwelling conditions are much less common than upwelling, with occurrences during winter and early fall storms with events lasting between two to five days. When the wind blows to the northeast with an intensity of 4 m/s or more for more than 12 hours, a well developed anticyclonic gyre forms in the middle of the bay. This is associated with a strong current, 35 to 40 cm/s, which flushes out in the southern part of the bay close to the coast off Point Pi os. This flow reverses when the winds veer to the southwest and enter into the Bay with less intensity.
DTIC
High Frequencies; Monterey Bay (Ca); Ocean Currents; Upwelling Water

20040086552 NASA Langley Research Center, Hampton, VA, USA
Characterization and Uncertainty Analysis of a Reference Pressure Measurement System for Wind Tunnels
Amer, Tahani; Tripp, John; Tcheng, Ping; Burkett, Cecil; Sealey, Bradley; [2004]; 12 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents the calibration results and uncertainty analysis of a high-precision reference pressure measurement system currently used in wind tunnels at the NASA Langley Research Center (LaRC). Sensors, calibration standards, and measurement instruments are subject to errors due to aging, drift with time, environment effects, transportation, the mathematical model, the calibration experimental design, and other factors. Errors occur at every link in the chain of measurements and data reduction from the sensor to the final computed results. At each link of the chain, bias and precision uncertainties must be separately estimated for facility use, and are combined to produce overall calibration and prediction confidence intervals for the instrument, typically at a 95% confidence level. The uncertainty analysis and calibration experimental designs used herein, based on techniques developed at LaRC, employ replicated experimental designs for efficiency, separate estimation of bias and precision uncertainties, and detection of significant parameter drift with time. Final results, including calibration confidence intervals and prediction intervals given as functions of the applied inputs, not as a fixed percentage of the full-scale value are presented. System uncertainties are propagated beginning with the initial reference pressure standard, to the calibrated instrument as a working standard in the facility. Among the several parameters that can affect the overall results are operating temperature, atmospheric pressure, humidity, and facility vibration. Effects of factors such as initial zeroing and temperature are investigated. The effects of the identified parameters on system performance and accuracy are discussed.
Author
Pressure Measurement; Wind Tunnels; Calibrating; Errors

20040086613 Forschungszentrum Juelich G.m.b.H., Juelich, Germany
DLS and FCS on Tracer Spheres in Concentrated Rod Dispersions
Kang, K.; Gapinski, J.; Lettinga, M. P.; Buitenhuis, J.; Meier, G.; Dhont, Jan K. G.; Patkowski, A.; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 15-17; In English; See also 20040086587; No Copyright; Avail: CASI; A01, Hardcopy

Diffusion of tracer spheres in dispersions of rods is measured by dynamic light scattering (DLS) and fluorescence correlation spectroscopy (FCS), as a function of the rod concentration and the size ratio of the sphere to the rod. By comparing with DLS\h FCS is shown to measure long-time diffusion only for relatively small spheres. A variational approach for the prediction of long-time self diffusion coefficients is compared with experiments.
Author
Light Scattering; Dynamical Systems; Fluorescence; Spectroscopy

20040086648 NASA Langley Research Center, Hampton, VA, USA
Physical Analysis and Scaling of a Jet and Vortex Actuator
Lachowicz, Jason T.; Yao, Chung-Sheng; Joslin, Ronald D.; August 23, 2004; 8 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

Our previous studies have shown that the Jet and Vortex Actuator generates free-jet, wall-jet, and near- wall vortex flow fields. That is, the actuator can be operated in different modes by simply varying the driving frequency and/or amplitude. For this study, variations are made in the actuator plate and wide-slot widths and sine/asymmetrical actuator plate input forcing (drivers) to further study the actuator induced flow fields. Laser sheet flow visualization, particle- image velocimetry, and laser velocimetry are used to measure and characterize the actuator induced flow fields. Laser velocimetry measurements indicate that the vortex strength increases with the driver repetition rate for a fixed actuator geometry (wide slot and plate width). For a given driver repetition rate, the vortex strength increases as the plate width decreases provided the wide-slot to plate-width

ratio is fixed. Using an asymmetric plate driver, a stronger vortex is generated for the same actuator geometry and a given driver repetition rate. The nondimensional scaling provides the approximate ranges for operating the actuator in the free jet, wall jet, or vortex flow regimes. Finally, phase-locked velocity measurements from particle image velocimetry indicate that the vortex structure is stationary, confirming previous computations. Both the computations and the particle image velocimetry measurements (expectantly) show unsteadiness near the wide-slot opening, which is indicative of mass ejection from the actuator.
Author
Actuators; Jet Flow; Velocity Measurement; Vortices; Laser Doppler Velocimeters

20040086703 NASA Langley Research Center, Hampton, VA, USA
Measuring Humidity in the Charters of Freedom Encasements Using a Moisture Condensation Method
Burkett, Cecil G.; West, James W.; Levine, Joel S.; [2004]; 18 pp.; In English; 2004 NCSL International Workshop and Symposium, 11-15 Jul. 2004, Salt lake City, UT, USA
Contract(s)/Grant(s): 23-72840-30; No Copyright; Avail: CASI; A03, Hardcopy

The relative humidity of the atmosphere in the encasements containing the U.S. Constitution Pages 1 and 4, the Declaration of Independence, and the Bill of Rights was measured to be in the range of 55% to 61%. This value is significantly higher than the presumed relative humidity between 25 to 35 %, but is consistent with the measured samples extracted from Pages 2 and 3 of the U.S. Constitution. The cooling/condensation measurement technique used at NARA on July 23, 2001, and described in this paper to measure the water vapor content of the atmosphere in the hermetically sealed encasements containing the U. S. Constitution, the Declaration of Independence, and the Bill of Rights, proved to be a powerful new measurement technique. The cooling/condensation technique developed at NASA LaRC and utilized at NARA has important applications in the non-invasive measurement of relative humidity in the atmospheres of sealed encasements and could become a standard measurement technique in this type of analysis.
Derived from text
Humidity Measurement; Moisture; Condensation; Temperature Measurement

20040086739 NASA Langley Research Center, Hampton, VA, USA
Photogrammetry Applied to Wind Tunnel Testing
Liu, Tian-Shu; Cattafesta, L. N., III; Radeztsky, R. H.; Burner, A. W.; AIAA Journal; June 2000; Volume 38, No. 6, pp. 964-971; In English; No Copyright; Avail: CASI; A03, Hardcopy

In image-based measurements, quantitative image data must be mapped to three-dimensional object space. Analytical photogrammetric methods, which may be used to accomplish this task, are discussed from the viewpoint of experimental fluid dynamicists. The Direct Linear Transformation (DLT) for camera calibration, used in pressure sensitive paint, is summarized. An optimization method for camera calibration is developed that can be used to determine the camera calibration parameters, including those describing lens distortion, from a single image. Combined with the DLT method, this method allows a rapid and comprehensive in-situ camera calibration and therefore is particularly useful for quantitative flow visualization and other measurements such as model attitude and deformation in production wind tunnels. The paper also includes a brief description of typical photogrammetric applications to temperature- and pressure-sensitive paint measurements and model deformation measurements in wind tunnels.
Author
Photogrammetry; Wind Tunnel Tests; Calibrating; Cameras

20040086743 NASA Langley Research Center, Hampton, VA, USA
An Airborne A-Band Spectrometer for Remote Sensing Of Aerosol and Cloud Optical Properties
Pitts, Michael; Hostetler, Chris; Poole, Lamont; Holden, Carl; Rault, Didier; [2000]; 10 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

Atmospheric remote sensing with the O2 A-band has a relatively long history, but most of these studies were attempting to estimate surface pressure or cloud-top pressure. Recent conceptual studies have demonstrated the potential of spaceborne high spectral resolution O2 A-band spectrometers for retrieval of aerosol and cloud optical properties. The physical rationale of this new approach is that information on the scattering properties of the atmosphere is embedded in the detailed line structure of the O2 A-band reflected radiance spectrum. The key to extracting this information is to measure the radiance spectrum at very high spectral resolution. Instrument performance requirement studies indicate that, in addition to high spectral resolution, the successful retrieval of aerosol and cloud properties from A-band radiance spectra will also require high

radiometric accuracy, instrument stability, and high signal-to-noise measurements. To experimentally assess the capabilities of this promising new remote sensing application, the NASA Langley Research Center is developing an airborne high spectral resolution A-band spectrometer. The spectrometer uses a plane holographic grating with a folded Littrow geometry to achieve high spectral resolution (0.5 cm-1) and low stray light in a compact package. This instrument will be flown in a series of field campaigns beginning in 2001 to evaluate the overall feasibility of this new technique. Results from these campaigns should be particularly valuable for future spaceborne applications of A-band spectrometers for aerosol and cloud retrievals.
Author
Aerosols; Remote Sensing; Cloud Physics; Oxygen; Spectrometers

20040086804 NASA Langley Research Center, Hampton, VA, USA
A Study on a Microwave-Driven Smart Material Actuator
Choi, Sang H.; Chu, Sang-Hyon; Kwak, M.; Cutler, A. D.; [2001]; 11 pp.; In English
Contract(s)/Grant(s): NAS1-97046; NCC1-217; No Copyright; Avail: CASI; A03, Hardcopy

NASA s Next Generation Space Telescope (NGST) has a large deployable, fragmented optical surface (greater than or = 2 8 m in diameter) that requires autonomous correction of deployment misalignments and thermal effects. Its high and stringent resolution requirement imposes a great deal of challenge for optical correction. The threshold value for optical correction is dictated by lambda/20 (30 nm for NGST optics). Control of an adaptive optics array consisting of a large number of optical elements and smart material actuators is so complex that power distribution for activation and control of actuators must be done by other than hard-wired circuitry. The concept of microwave-driven smart actuators is envisioned as the best option to alleviate the complexity associated with hard-wiring. A microwave-driven actuator was studied to realize such a concept for future applications. Piezoelectric material was used as an actuator that shows dimensional change with high electric field. The actuators were coupled with microwave rectenna and tested to correlate the coupling effect of electromagnetic wave. In experiments, a 3x3 rectenna patch array generated more than 50 volts which is a threshold voltage for 30-nm displacement of a single piezoelectric material. Overall, the test results indicate that the microwave-driven actuator concept can be adopted for NGST applications.
Author
Microwaves; Actuators; Adaptive Optics; Piezoelectricity

20040086806 NASA Langley Research Center, Hampton, VA, USA
Fiber Optic Sensors for Health Monitoring of Morphing Aircraft
Brown, Timothy; Wood, Karen; Childers, Brooks; Cano, Roberto; Jensen, Brian; Rogowski, Robert; [2001]; 13 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Fiber optic sensors are being developed for health monitoring of future aircraft. Aircraft health monitoring involves the use of strain, temperature, vibration and chemical sensors. These sensors will measure load and vibration signatures that will be used to infer structural integrity. Sine the aircraft morphing program assumes that future aircraft will be aerodynamically reconfigurable there is also a requirement for pressure, flow and shape sensors. In some cases a single fiber may be used for measuring several different parameters. The objective of the current program is to develop techniques for using optical fibers to monitor composite cure in real time during manufacture and to monitor in-service structural integrity of the composite structure. Graphite-epoxy panels were fabricated with integrated optical fibers of various types. The panels were mechanically and thermally tested to evaluate composite strength and sensor durability. Finally the performance of the fiber optic sensors was determined. Experimental results are presented evaluating the performance of embedded and surface mounted optical fibers for measuring strain, temperature and chemical composition. The performance of the fiber optic sensors was determined by direct comparison with results from more conventional instrumentation. The facilities for fabricating optical fiber and associated sensors and methods of demodulating Bragg gratings for strain measurement will be described.
Author
Fiber Optics; Temperature Measurement; Temperature Sensors; Structural Failure; Pressure Sensors; Optical Fibers; Chemical Composition

20040086810 NASA Langley Research Center, Hampton, VA, USA
Assessment of Selected CERES Electronic Component Survivability under Simulated Overvoltage Conditions
Chapman, John J.; Grant, M. S.; Bockman, J.; Clark, V. M.; Hess, P. C.; [1999]; 8 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

In August, 1998 a Clouds and the Earth’s Radiant Energy System (CERES) instrument telemetry housekeeping parameter

generated a yellow warning message that indicated an on-board + 15V Data Acquisition Assembly (DAA) power converter deregulation anomaly. An exhaustive investigation was undertaken to understand this anomaly and the long-term consequences which have severely reduced CERES operations on the Tropical Rainfall Measuring Mission (TRMM) spacecraft. Among investigations performed were ground tests that approximated the on-board electronic circuitry using a small quantity of flight identical components exposed to maximum spacecraft bus over-voltage conditions. These components include monolithic integrated microcircuits that perform analog signal conditioning on instrument sensor signals and an analog- to-digital converter (ADC) for the entire DAA. All microcircuit packages have either a bipolar silicon design with internal current limiting protections or have a complementary metal oxide semiconductor (CMOS) design with bias protections. Ground tests that have been running for approximately 8 months have indicated that these components are capable of withstanding as much as twice their input supply voltage ratings without noticeable performance degradation. These data provide CERES operators with confidence of being able to continue science operations over the remaining life of the TRMM mission. This paper will discuss this anomaly and some possible causes, a simulator of affected electronics, test results, prognosis for future CERES operations, and conclusions.
Author
Analog to Digital Converters; Radiant Flux Density; Telemetry; Data Acquisition

20040086815 NASA Langley Research Center, Hampton, VA, USA
Visualization of Subsurface Defects in Composites using a Focal Plane Array Infrared Camera
Plotnikov, Yuri A.; Winfree, William P.; [1999]; 6 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

A technique for enhanced defect visualization in composites via transient thermography is presented in this paper. The effort targets automated defect map construction for multiple defects located in the observed area. Experimental data were collected on composite panels of different thickness with square inclusions and flat bottom holes of different depth and orientation. The time evolution of the thermal response and spatial thermal profiles are analyzed. The pattern generated by carbon fibers and the vignetting effect of the focal plane array camera make defect visualization difficult. An improvement of the defect visibility is made by the pulse phase technique and the spatial background treatment. The relationship between a size of a defect and its reconstructed image is analyzed as well. The image processing technique for noise reduction is discussed.
Author
Image Analysis; Thermography; Focal Plane Devices; Nondestructive Tests; Infrared Imagery; Composite Structures

20040086908 NASA Ames Research Center, Moffett Field, CA, USA
Adaptive DFT-based Interferometer Fringe Tracking
Wilson, Edward; Pedretti, Ettore; Bregman, Jesse; Mah, Robert W.; Traub, Wesley A.; June 1, 2004; 17 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

An automatic interferometer fringe tracking system has been developed, implemented, and tested at the Infrared Optical Telescope Array (IOTA) observatory at Mt. Hopkins, Arizona. The system can minimize the optical path differences (OPDs) for all three baselines of the Michelson stellar interferometer at IOTA. Based on sliding window discrete Fourier transform (DFT) calculations that were optimized for computational efficiency and robustness to atmospheric disturbances, the algorithm has also been tested extensively on off-line data. Implemented in ANSI C on the 266 MHz PowerPC processor running the VxWorks real-time operating system, the algorithm runs in approximately 2.0 milliseconds per scan (including all three interferograms), using the science camera and piezo scanners to measure and correct the OPDs. The adaptive DFT-based tracking algorithm should be applicable to other systems where there is a need to detect or track a signal with an approximately constant-frequency carrier pulse.
Author
Discrete Functions; Fourier Transformation; Tracking (Position); Diffraction Patterns; Adaptive Control; Michelson Interferometers; Algorithms

20040086970 NASA Langley Research Center, Hampton, VA, USA
Enhanced Imaging of Corrosion in Aircraft Structures with Reverse Geometry X-ray(registered tm)
Winfree, William P.; Cmar-Mascis, Noreen A.; Parker, F. Raymond; [2000]; 12 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

The application of Reverse Geometry X-ray to the detection and characterization of corrosion in aircraft structures is presented. Reverse Geometry X-ray is a unique system that utilizes an electronically scanned x-ray source and a discrete

detector for real time radiographic imaging of a structure. The scanned source system has several advantages when compared to conventional radiography. First, the discrete x-ray detector can be miniaturized and easily positioned inside a complex structure (such as an aircraft wing) enabling images of each surface of the structure to be obtained separately. Second, using a measurement configuration with multiple detectors enables the simultaneous acquisition of data from several different perspectives without moving the structure or the measurement system. This provides a means for locating the position of flaws and enhances separation of features at the surface from features inside the structure. Data is presented on aircraft specimens with corrosion in the lap joint. Advanced laminographic imaging techniques utilizing data from multiple detectors are demonstrated to be capable of separating surface features from corrosion in the lap joint and locating the corrosion in multilayer structures. Results of this technique are compared to computed tomography cross sections obtained from a microfocus x-ray tomography system. A method is presented for calibration of the detectors of the Reverse Geometry X-ray system to enable quantification of the corrosion to within 2%.
Author
Aircraft Structures; Imaging Techniques; Corrosion; X Ray Sources; Radiography

20040087120 NASA Ames Research Center, Moffett Field, CA, USA
Aerosol Optical Depth Measurements by Airborne Sun Photometer in SOLVE II: Comparisons to SAGE III, POAM III and Airborne Spectrometer Measurements
Russell, P.; Livingston, J.; Schmid, B.; Eilers, J.; Kolyer, R.; Redemann, J.; Ramirez, S.; Yee, J-H.; Swartz, W.; Shetter, R., et al.; [2004]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

The 14-channel NASA Ames Airborne Tracking Sunphotometer (AATS-14) measured solar-beam transmission on the NASA DC-8 during the Second SAGE III Ozone Loss and Validation Experiment (SOLVE II). This paper presents AATS-14 results for multiwavelength aerosol optical depth (AOD), including its spatial structure and comparisons to results from two satellite sensors and another DC-8 instrument. These are the Stratospheric Aerosol and Gas Experiment III (SAGE III), the Polar Ozone and Aerosol Measurement III (POAM III) and the Direct beam Irradiance Airborne Spectrometer (DIAS).
Author
Aerosols; Airborne Equipment; Optical Thickness; Ozone; Sun; Polar Regions; NASA Programs; Spectrophotometers; Solar Sensors

20040087144 NASA Langley Research Center, Hampton, VA, USA
A Holographic Interferometer System for Measuring Density Profiles in High-Velocity Flows
Burner, Alpheus W.; [1972]; 6 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

This paper describes a holographic interferometric technique for obtaining density measurements across a test gas that is traveling at a velocity of over 5500 meters per second in an expansion tube facility. Interferometric data describing the flow in the test section are obtained using a long coherence length cw argon laser in a holographic system and a rotating drum camera recorder. The object beam, which passes through the test section, intersects the reference beam at a small angle (5 degrees) to form an interference pattern of about 170 lines per millimeter, and is recorded as a hologram. Before a test, this hologram is placed in its original position and rotated slightly so that an interference pattern is generated by the intersection of the reconstructed and real-time object beams. This interference pattern is adjusted to a series of bright, horizontal fringes having a spatial frequency of about 5 fringes per centimeter. During the few milliseconds it takes the test gas to pass through the test section, variations in the gas density across the 8.4-centimeter test section produce phase variations in the object beam and result in a varying interference pattern. A rotating drum camera with a 0.15-millimeter slit aligned perpendicular to the fringes is used to record the varying fringe shifts with a time resolution of about 3 microseconds. The average gas density across the test section is determined by measuring these fringe shifts.
Author
Density Measurement; Holographic Interferometry; Velocity Distribution; Flow Distribution

20040087267 NASA Langley Research Center, Hampton, VA, USA
Application of a Planar Doppler Velocimetry System to a High Reynolds Number Compressible Jet
Smith, Michael W.; [1998]; 20 pp.; In English; 36th AIAA Aerospace Sciences Meeting and Exhibit, 12-15 Jan. 1998, Reno, Nevada, USA
Report No.(s): AIAA Paper 98-0428; Copyright; Avail: CASI; A03, Hardcopy

A Planar Doppler Velocimetry (PDV) system has been constructed and used to investigate the instantaneous turbulent velocity structure of a round high-speed compressible air jet with a low-speed co-flow. The exit condition was Mach=0.85 at

ambient pressure, yielding a Reynolds number of about 650,000 on diameter. The PDV system was installed at NASA Langley Research Center in the Small Anechoic Jet Facility (SAJF), a chamber in which both the acoustic and aerodynamic properties of jets can be studied. For this test, the goal was to gather data which can be used to relate the turbulence structure of the jet to the levels and character of the acoustic noise produced by the jet. The current PDV system can acquire single-velocity-component, single-shot, planar images (15ns exposures) at 30 Hz. For this paper, the primary data set consists of 240 frames of velocity data acquired with both the jet and the low-speed co-flow seeded with light-scattering articles. Thus, velocities could be measured everywhere in the jet shear layer, both in the jet fluid and in the entrained co-flow. Some data were also taken with only the jet flow seeded. These provided mixing concentration images along with the reduced velocity fields. Other images were taken with only the co-flow seeded. These produced unique quantitative images of high speed entrainment. Optical 'laser speckle' noise is the largest source of random noise in pulsed PDV systems. Components for the PDV imaging system were specifically selected to minimize speckle noise. To reduce systematic velocity errors due to laser drift, a frequency monitoring reference leg with a temperature-tuned reference iodine cell, was employed. In the course of this study, a novel flow seeder was developed. It enabled continuously variable seeding of the flow with particles of Sheared Pyrogenic Amorphous Hydrophobic Silica (SPAHS). The seeder comprised a dry fluidized bed hopper and a supersonic nozzle 'pickup.' Shearing action in the pickup dispersed the seed material in an exceptionally fine cloud (approximately 0.3 micron). These particles followed the flow well, did not clump or cake on screens or model surfaces, and were not susceptible to evaporation. Because of the refractory nature of the particles, SPAHS seeding should also be applicable to anticipated future testing at high temperatures.
Author
Velocity Measurement; Anechoic Chambers; Laser Outputs; Acoustic Properties; Jet Flow; Particle Image Velocimetry; Velocity Distribution

20040087338 NASA Ames Research Center, Moffett Field, CA, USA
Data Fusion in Wind Tunnel Testing; Combined Pressure Paint and Model Deformation Measurements (Invited)
Bell, James H.; Burner, Alpheus W.; [2004]; 21 pp.; In English; 20th Advanced Measurement and Ground Testing Meeting, 15-18 Jun. 1998, Albuquerque, NM, USA
Report No.(s): AIAA Paper 98-2500; Copyright; Avail: CASI; A03, Hardcopy

As the benefit-to-cost ratio of advanced optical techniques for wind tunnel measurements such as Video Model Deformation (VMD), Pressure-Sensitive Paint (PSP), and others increases, these techniques are being used more and more often in large-scale production type facilities. Further benefits might be achieved if multiple optical techniques could be deployed in a wind tunnel test simultaneously. The present study discusses the problems and benefits of combining VMD and PSP systems. The desirable attributes of useful optical techniques for wind tunnels, including the ability to accommodate the myriad optical techniques available today, are discussed. The VMD and PSP techniques are briefly reviewed. Commonalties and differences between the two techniques are discussed. Recent wind tunnel experiences and problems when combining PSP and VMD are presented, as are suggestions for future developments in combined PSP and deformation measurements.
Author
Pressure Sensitive Paints; Wind Tunnel Tests; Multisensor Fusion; Deformation; Aircraft Models; Video Communication

20040090470 Michigan Univ., Ann Arbor, MI, USA
Novel Biomedical Devices Utilizing Light-Emitting Nanostructures
Goldman, Rachel S.; [2004]; 2 pp.; In English
Contract(s)/Grant(s): NAG3-2787; No Copyright; Avail: CASI; A01, Hardcopy

As part of the NASA project, we are investigating the formation, properties, and performance of QD heterostructures, to be incorporated into a novel biomedical device for detecting bacteria and/or viruses in fluids on board space vehicles. We are presently synthesizing the epitaxial quantum dot structures using molecular beam epitaxy. We recently developed a method for controlling the arrangement of QDs, based upon a combination of buffer layer growth and controlled annealing sequences. This method is promising for producing arrangements of QDs with a locally well-controlled distribution of sizes. In the future, we plan to explore selective pre-patterning of the starting surface using focused ion-beam nanopatterning, which will enable us to precisely tune the compositions, sizes, and placement of the QDs, in order laterally tune the emission and detection wavelengths of QD based devices.
Author (revised)
Bioinstrumentation; Nanostructures (Devices); Quantum Dots

20040090487 NASA Langley Research Center, Hampton, VA, USA

Hardening Doppler Global Velocimetry Systems for Large Wind Tunnel Applications

Meyers, James F.; Lee, Joseph W.; Fletcher, Mark T.; South, Bruce W.; [2004]; 30 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

The development of Doppler Global Velocimetry from a laboratory curiosity to a wind tunnel instrumentation system is discussed. This development includes system advancements from a single velocity component to simultaneous three components, and from a steady state to instantaneous measurement. Improvements to system control and stability are discussed along with solutions to real world problems encountered in the wind tunnel. This on-going development program follows the cyclic evolution of understanding the physics of the technology, development of solutions, laboratory and wind tunnel testing, and reevaluation of the physics based on the test results.

Author

Hardening (Systems); Wind Tunnel Apparatus; Laser Doppler Velocimeters

20040090488 NASA Langley Research Center, Hampton, VA, USA

Digital PIV Measurements of Acoustic Particle Displacements in a Normal Incidence Impedance Tube

Humphreys, William M., Jr.; Bartram, Scott M.; Parrott, Tony L.; Jones, Michael G.; [1998]; 16 pp.; In English; 20th AIAA Advanced Measurement and Ground Testing Technology Conference, 15-18 Jun. 1998, Albuquerque, NM, USA

Report No.(s): AIAA Paper 98-2611; Copyright; Avail: CASI; A03, Hardcopy

Acoustic particle displacements and velocities inside a normal incidence impedance tube have been successfully measured for a variety of pure tone sound fields using Digital Particle Image Velocimetry (DPIV). The DPIV system utilized two 600-mj Nd:YAG lasers to generate a double-pulsed light sheet synchronized with the sound field and used to illuminate a portion of the oscillatory flow inside the tube. A high resolution (1320 x 1035 pixel), 8-bit camera was used to capture double-exposed images of 2.7-micron hollow silicon dioxide tracer particles inside the tube. Classical spatial autocorrelation analysis techniques were used to ascertain the acoustic particle displacements and associated velocities for various sound field intensities and frequencies. The results show that particle displacements spanning a range of 1-60 microns can be measured for incident sound pressure levels of 100-130 dB and for frequencies spanning 500-1000 Hz. The ability to resolve 1 micron particle displacements at sound pressure levels in the 100 dB range allows the use of DPIV systems for measurement of sound fields at much lower sound pressure levels than had been previously possible. Representative impedance tube data as well as an uncertainty analysis for the measurements are presented.

Author

Digital Techniques; Particle Image Velocimetry; Acoustic Measurement

20040090623 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Cryogenic, High-Accuracy, Refraction Measuring System (CHARMS): A New Facility for Cryogenic Infrared through Vacuum Far-Ultraviolet Refractive Index Measurements

Frey, Bradley J.; Leviton, Douglas B.; [2004]; 1 pp.; In English; SPIE Astronomical Telescope and Instrumentation, 21-25 Jun. 2004, USA; No Copyright; Avail: Other Sources; Abstract Only

The optical designs of future NASA infrared (IR) missions and instruments, such as the James Webb Space Telescope's (JWST) Near-Mixed Camera (NIRCam), will rely on accurate knowledge of the index of refraction of various IR optical materials at cryogenic temperatures. To meet this need, we have developed a Cryogenic, High-Accuracy Refraction Measuring System (CHARMS). In this paper we discuss the completion of the design and construction of CHARMS as well as the engineering details that constrained the final design and hardware implementation. In addition, we will present our first light, cryogenic, IR index of refraction data for LiF, BaF2, and CaF2, and compare our results to previously published data for these materials.

Author

Cryogenics; Refractometers

20040095303 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Estimations of the Global Distribution and Time Series of UV Noontime Irradiance (305, 310, 324, 380 nm, and Erythemal) from TOMS and SeaWiFS Data

Herman, J.; [2004]; 1 pp.; In English; International Quadrennial Ozone Symposium (QOS 2004), 1-8 Jun. 2004, Kos, Greece; No Copyright; Avail: Other Sources; Abstract Only

The amount of UV irradiance reaching the Earth's surface is estimated from the measured cloud reflectivity, ozone,

aerosol amounts, and surface reflectivity time series from 1980 to 1992 and 1997 to 2000 to estimate changes that have occurred over a 21-year period. Recent analysis of the TOMS data shows that there has been an apparent increase in reflectivity (decrease in W) in the Southern Hemisphere that is related to a calibration error in EP-TOMS. Data from the well-calibrated SeaWiFS satellite instrument have been used to correct the EP-TOMS reflectivity and UV time series. After correction, some of the local trend features seen in the N7 time series (1980 to 1992) have been continued in the combined time series, but the overall zonal average and global trends have changed. In addition to correcting the EP-TOMS radiance calibration, the use of SeaWiFS cloud data permits estimation of UV irradiance at higher spatial resolution (1 to 4 km) than is available from TOMS (100 km) under the assumption that ozone is slowly varying over a scale of 100 km. The key results include a continuing decrease in cloud cover over Europe and North America with a corresponding increase in UV and a decrease in UV irradiance near Antarctica.
Author
Irradiance; Sea-Viewing Wide Field-of-View Sensor; Time Series Analysis; Total Ozone Mapping Spectrometer; Ultraviolet Radiation; Noon; Data Acquisition

20040095334 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Antenna Linear-Quadratic-Gaussian (LQG) Controllers: Properties, Limits of Performance, and Tuning Procedure
Gawronski, W.; Interplanetary Network Progress Report; August 15, 2004; Volume 42-158; 18 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Wind gusts are the main disturbances that depreciate tracking precision of microwave antennas and radiotelescopes. The linear-quadratic-Gaussian (LQG) controllers - as compared with the proportional-and-integral (PI) controllers significantly improve the tracking precision in wind disturbances. However, their properties have not been satisfactorily understood; consequently, their tuning is a trial-and-error process. A control engineer has two tools to tune an LQG controller: the choice of coordinate system of the controller model and the selection of weights of the LQG performance index. This article analyzes properties of an open- and closed-loop antenna. It shows that the proper choice of coordinates of the open-loop model simplifies the shaping of the closed-loop performance. The closed-loop properties are influenced by the LQG weights. The article shows the impact of the weights on the antenna closed-loop bandwidth, disturbance rejection properties, and antenna acceleration. The bandwidth and the disturbance rejection characterize the antenna performance, while the acceleration represents the performance limit set by the antenna hardware (motors). The article presents the controller tuning procedure, based on the coordinate selection and the weight properties. The procedure rationally shapes the closed-loop performance, as an alternative to the trial-and-error approach.
Author
Antenna Components; Linear Quadratic Gaussian Control; Performance Prediction

20040095337 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Using Trained Pixel Classifiers to Select Images of Interest
Mazzoni, D.; Wagstaff, K.; Castano, R.; Interplanetary Network Progress Report; August 15, 2004; Volume 42-158; 8 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

We present a machine-learning-based approach to ranking images based on learned priorities. Unlike previous methods for image evaluation, which typically assess the value of each image based on the presence of predetermined specific features, this method involves using two levels of machine-learning classifiers: one level is used to classify each pixel as belonging to one of a group of rather generic classes, and another level is used to rank the images based on these pixel classifications, given some example rankings from a scientist as a guide. Initial results indicate that the technique works well, producing new rankings that match the scientist's rankings significantly better than would be expected by chance. The method is demonstrated for a set of images collected by a Mars field-test rover.
Author
Machine Learning; Image Analysis; Pixels; Classifications

36
LASERS AND MASERS

Includes lasing theory, laser pumping techniques, maser amplifiers, laser materials, and the assessment of laser and maser outputs. For cases where the application of the laser or maser is emphasized see also the specific category where the application is treated. For related information see also *76 Solid-State Physics*.

20040085705 NASA Langley Research Center, Hampton, VA, USA
NASA's New Laser Risk Reduction Program For Future Space Lidar Missions
Kavaya, Michael J.; Singh, Upendra N.; Heaps, William S.; Cazeau, Tony; [2002]; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

NASA has been performing ground, airborne, and space-based scientific measurements since it was formed in 1958. Initial ground and airborne measurements were made with in situ instruments. By necessity, initial earth observation space-based missions were accomplished with passive remote sensing. Active microwave radar was added to the sensor repertoire in the late 1970s. A few key measurements important to NASA remain unaccomplished, however, despite the passive and radar successes. These critical measurements include space-based altimetry; and high spatial resolution profiling of aerosol properties, wind velocity, clouds, and molecular concentrations. Fortunately, a new technology, active optical radar or laser radar or lidar, has matured to the point that the last decade has seen a growing consideration of lidar for space missions. Part of the surge in consideration of lidar has been the tremendous progress in solid-state lasers fueled by advances in crystal growth quality and pump laser diode technology.
Derived from text
Enhanced Vision; Crystal Growth; Microwaves; Measurement; Aerosols; Wind Velocity; Molecular Properties

20040086596 Kyushu Univ., Fukuoka, Japan
Spatial Properties of a Superposed Speckle Field and Its Application to the Fabrication of Random Laser Media
Okamoto, Takashi; Gotou, Hiroyuki; Yonemori, Tatsuya; Kawabata, Yasuaki; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 86-88; In English; See also 20040086587; No Copyright; Avail: CASI; A01, Hardcopy

The statistical properties of a three-dimensional laser speckle field produced by three scattered waves superposed with one another are studied theoretically. It is shown that the spatial anisotropy of intensity distributions still remains even when the three speckle fields are interfered with one another. Superposed fractal speckles and their binarized intensity are also investigated in terms of spatial self-similarity. A new method for fabricating random laser media with the use of photopolymers is proposed, and a preliminary experiment is performed.
Author
Statistical Distributions; Photopolymers; Spatial Distribution; Fabrication

20040086598 Fribourg Univ., Switzerland
A PCS Study of Correlations and Fluctuations in the Laser Speckle Pattern
Balog, Sandor; Saenz, Juan Jose; Scheffold, Frank; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 102-104; In English; See also 20040086587; No Copyright; Avail: CASI; A01, Hardcopy

Fluctuations and correlations in the transmission speckle pattern are analyzed with Photon Correlation Spectroscopy (PCS) for the case of finite sized random media.
Author (revised)
Speckle Patterns; Spectroscopy; Correlation; Laser Beams

20040086661 Alabama Univ., Huntsville, AL, USA
Solar Pumped High Power Solid State Laser for Space Applications
Fork, Richard L.; Laycock, Rustin L.; Green, Jason J. A.; Walker, Wesley W.; Cole, Spencer T.; Frederick, Kevin B.; Phillips, Dane J.; [2004]; 2 pp.; In English; Fourth International Conference on Solar Power from Space, 30 Jun. - 2 Jul. 2004, Granada, Spain
Contract(s)/Grant(s): NCC8-200; No Copyright; Avail: CASI; A01, Hardcopy

Highly coherent laser light provides a nearly optimal means of transmitting power in space. The simplest most direct means of converting sunlight to coherent laser light is a solar pumped laser oscillator. A key need for broadly useful space solar power is a robust solid state laser oscillator capable of operating efficiently in near Earth space at output powers in the multi hundred kilowatt range. The principal challenges in realizing such solar pumped laser oscillators are: (1) the need to remove heat from the solid state laser material without introducing unacceptable thermal shock, thermal lensing, or thermal stress

induced birefringence to a degree that improves on current removal rates by several orders of magnitude and (2) to introduce sunlight at an effective concentration (kW/sq cm of laser cross sectional area) that is several orders of magnitude higher than currently available while tolerating a pointing error of the spacecraft of several degrees. We discuss strategies for addressing these challenges. The need to remove the high densities of heat, e.g., 30 kW/cu cm, while keeping the thermal shock, thermal lensing and thermal stress induced birefringence loss sufficiently low is addressed in terms of a novel use of diamond integrated with the laser material, such as Ti:sapphire in a manner such that the waste heat is removed from the laser medium in an axial direction and in the diamond in a radial direction. We discuss means for concentrating sunlight to an effective areal density of the order of 30 kW/sq cm. The method integrates conventional imaging optics, non-imaging optics and nonlinear optics. In effect we use a method that combines some of the methods of optical pumping solid state materials and optical fiber, but also address laser media having areas sufficiently large, e.g., 1 cm diameter to handle the multi-hundred kilowatt level powers needed for space solar power.
Author
Optical Pumping; Solid State Lasers; Laser Power Beaming; Oscillators

20040086863 NASA Langley Research Center, Hampton, VA, USA
An Efficient End-Pumped Ho:Tm:YLF Disk Amplifier
Yu, Ji-Rong; Petros, Mulugeta; Singh, Upendra N.; Barnes, Norman P.; [2000]; 4 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

An efficient diode-pumped, room temperature Ho:Tm:YLF disk amplifier was realized by end-pump configuration. Compared to side pump configuration, about a factor three improvement in system efficiency has been demonstrated.
Author
Laser Applications; Amplifier Design; Semiconductor Lasers; Ylf Lasers

20040086864 NASA Langley Research Center, Hampton, VA, USA
High Energy Directly Pumped Ho:YLF Laser
Petros, Mulugeta; Yu, Ji-Rong; Singh, Upendra N.; Barnes, Norman P.; [2000]; 4 pp.; In English; Copyright; Avail: CASI; A01, Hardcopy

The most commonly used crystal architecture to produce 2 micrometer laser is co-doping Ho and Tm into a single host crystal. In this method, the stored energy transfer from the Tm (3)F4 to the Ho (5)I7 manifold is not fast enough to warrant high efficiency for short pulse applications. By separating the Ho and the Tm ions and doping the Tm in YALO3 and the Ho in YLF, we were able to directly pump the Ho (5)I7 manifold with 1.94 micrometers. The Ho:YLF laser has produced 33 mJ at 2.062 micrometers with a quantum efficiency of 0.88. The performance of each laser will be presented.
Author
Holmium; Thulium; Energy Transfer; Lasers; Laser Pumping

37
MECHANICAL ENGINEERING

Includes mechanical devices and equipment; machine elements and processes. For cases where the application of a device or the host vehicle is emphasized see also the specific category where the application or vehicle is treated. For robotics see *63 Cybernetics, Artificial Intelligence, and Robotics*; and *54 Man/System Technology and Life Support*.

20040086105 Northrop Grumman Systems Corp., Linthicum, MD
Application of Commercial Parts Obsolescence Management (CPOM)
Rennenkampf, Erik; Rhyne, Rich; Feb. 2004; 49 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-99-2-5500; Proj-2865
Report No.(s): AD-A424388; AFRL-ML-WP-TR-2004-4104; No Copyright; Avail: CASI; A03, Hardcopy

Northrop Grumman Electronic Systems (Baltimore, Maryland) in cooperation with the AFRL Material and Manufacturing Directorate (WPAFB, Ohio) developed a 58-month ManTech obsolescence program to pursue a diverse group of tasks in various areas of parts obsolescence. The objective of the program was to reliably use COTS parts in military systems, implement ManTech funded tools and processes, integrate tools and processes in the Northrop Grumman design environment,

and document the resulting cost avoidance. The program has completed its work with notable success. This succinct report highlights the results and benefits.
DTIC
Logistics Management

20040086569 NASA Langley Research Center, Hampton, VA, USA
Further Development of an Optimal Design Approach Applied to Axial Magnetic Bearings
Bloodgood, V. Dale, Jr.; Groom, Nelson J.; Britcher, Colin P.; [2000]; 6 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

Classical design methods involved in magnetic bearings and magnetic suspension systems have always had their limitations. Because of this, the overall effectiveness of a design has always relied heavily on the skill and experience of the individual designer. This paper combines two approaches that have been developed to aid the accuracy and efficiency of magnetostatic design. The first approach integrates classical magnetic circuit theory with modern optimization theory to increase design efficiency. The second approach uses loss factors to increase the accuracy of classical magnetic circuit theory. As an example, an axial magnetic thrust bearing is designed for minimum power.
Author
Magnetic Bearings; Magnetic Suspension; Design Analysis

20040086583 NASA Langley Research Center, Hampton, VA, USA
Modeling the Influence of Stitching on Delamination Growth in Stitched Warp-Knit Composite Lap Joints
Glaessgen, E. H.; Raju, I. S.; Poe, C. C., Jr.; [1999]; 10 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

The effect of stitches on the failure of a single lap joint configuration was determined in a combined experimental and analytical study. The experimental study was conducted to determine debond growth under static monotonic loading. The stitches were shown to delay the initiation of the debond and provide load transfer beyond the load necessary to completely debond the stitched lap joint. The strain energy release rates at the debond front were calculated using a finite element-based technique. Models of the unstitched configuration showed significant values of modes I and II across the width of the joint and showed that mode III is zero at the centerline but increases near the free edge. Models of the stitched configuration showed that the stitches effectively reduced mode I to zero, but had less of an effect on modes II and III.
Author
Crack Closure; Lap Joints; Strain Energy Release Rate

20040086761 NASA Langley Research Center, Hampton, VA, USA
Mechanism Design Principle for Optical-Precision, Deployable Instruments
Lake, Mark S.; Hachkowski, M. Roman; [2000]; 10 pp.; In English; 41st AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 3-6 Apr. 2000, Atlanta, GA, USA
Report No.(s): AIAA Paper 2000-1409; Copyright; Avail: CASI; A02, Hardcopy

The present paper is intended to be a guide for the design of 'microdynamically quiet' deployment mechanisms for optical-precision structures, such as deployable telescope mirrors and optical benches. Many of the guidelines included herein come directly from the field of optomechanical engineering, and are neither newly developed guidelines nor are they uniquely applicable to high-precision deployment mechanisms. However, the application of these guidelines to the design of deployment mechanisms is a rather new practice, so efforts are made herein to illustrate the process through the discussion of specific examples. The present paper summarizes a more extensive set of design guidelines for optical-precision mechanisms that are under development.
Author
Optical Equipment; Deployment; Structural Design

20040086788 Chicago Univ., Chicago, IL, USA
New Design and Improvement of Planetary Gear Trains
Handschuh, Robert, Technical Monitor; Litvin, Faydor L.; Fuentes, Alfonso; Vecchiato, Daniele; Gonzalez-Perez, Ignacio; July 2004; 32 pp.; In English
Contract(s)/Grant(s): NAG3-2450; WBS 22-714-09-15; DA Proj. 1L1-62211A-47-A
Report No.(s): NASA/CR-2004-213101; ARL-CR-0540; E-14576; No Copyright; Avail: CASI; A03, Hardcopy

The development of new types of planetary and planetary face-gear drives is proposed. The new designs are based on

regulating backlash between the gears and modifying the tooth surfaces to improve the design. The goal of this work is to obtain a nearly uniform distribution of load between the planet gears. In addition, a new type of planetary face-gear drive was developed in this project.
Author
Planets; Gears; Mechanical Drives; Mechanical Engineering

20040086822 NASA Langley Research Center, Hampton, VA, USA
Buckling Behavior of Compression-Loaded Quasi-Isotropic Curved Panels with a Circular Cutout
Hillburger, Mark W.; Britt, Vicki O.; Nemeth, Michael P.; [1999]; 20 pp.; In English; 40th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 12-15 Apr. 1999, Saint Louis, MO, USA
Contract(s)/Grant(s): NASW-8154
Report No.(s): AIAA Paper 99-1279; Copyright; Avail: CASI; A03, Hardcopy

Results from a numerical and experimental study of the response of compression-loaded quasi-isotropic curved panels with a centrally located circular cutout are presented. The numerical results were obtained by using a geometrically nonlinear finite element analysis code. The effects of cutout size, panel curvature and initial geo- metric imperfections on the overall response of compression-loaded panels are described. In addition, results are presented from a numerical parametric study that indicate the effects of elastic circumferential edge restraints on the prebuckling and buckling response of a selected panel and these numerical results are compared to experimentally measured results. These restraints are used to identify the effects of circumferential edge restraints that are introduced by the test fixture that was used in the present study. It is shown that circumferential edge restraints can introduce substantial nonlinear prebuckling deformations into shallow compression-loaded curved panels that can results in a significant increase in buckling load.
Author
Numerical Analysis; Isotropy; Deformation; Curved Panels

20040087294 Colorado State Univ., Fort Collins, CO, USA, National Energy Technology Lab., Pittsburgh, PA
Low-Engine-Friction Technology for Advanced Natural-Gas Reciprocating Engines
Wong, V. W.; Tian, T.; Smedley, G.; Aug. 2003; In English
Report No.(s): DE2004-822221; No Copyright; Avail: National Technical Information Service (NTIS)

This program aims at improving the efficiency of advanced natural-gas reciprocating engines (ANGRE) by reducing piston/ring assembly friction without major adverse effects on engine performance, such as increased oil consumption and emissions. A detailed set of piston/ring dynamic and friction models have been developed and applied that illustrated the fundamental relationships between design parameters and friction losses. Various lowfriction strategies and concepts have been explored, and engine experiments will validate these concepts. An iterative process of experimentation, simulation and analysis, will be followed with the goal of demonstrating a complete optimized low-friction engine system. As planned, MIT has developed guidelines for an initial set of low-friction piston-ring-pack designs. Current recommendations focus on subtle top-piston-ring and oil-control-ring characteristics. A full-scale Waukesha F18 engine has been installed at Colorado State University and testing of the baseline configuration is in progress. Components for the first design iteration are being procured. Subsequent work includes examining the friction and engine performance data and extending the analyses to other areas to evaluate opportunities for further friction improvement and the impact on oil consumption/emission and wear, towards demonstrating an optimized reduced-friction engine system.
NTIS
Piston Engines; Natural Gas; Friction

20040090445 NASA Langley Research Center, Hampton, VA, USA
Buckling and Stable Tearing Responses of Unstiffened Aluminum Shells with Long Cracks
Starnes, James H., Jr.; Rose, Cheryl A.; [1998]; 13 pp.; In English
Report No.(s): AIAA Paper 98-1991; Copyright; Avail: CASI; A03, Hardcopy

The results of an analytical and experimental study of the nonlinear response of thin, unstiffened, aluminum cylindrical shells with a long longitudinal crack are presented. The shells are analyzed with a nonlinear shell analysis code that accurately accounts for global and local structural response phenomena. Results are presented for internal pressure and for axial compression loads. The effect of initial crack length on the initiation of stable tearing and unstable crack growth in typical shells subjected to internal pressure loads is predicted using geo- metrically nonlinear elastic-plastic finite element analyses. The results of these analyses and of the experiments indicate that the pressure required to initiate stable tearing and unstable

tearing in a shell subjected to internal pressure loads decreases as the crack length increases. The effects of crack length on the prebuckling, buckling and postbuckling responses of typical shells subjected to axial compression are also described. For this loading condition, the crack length is held constant. The results of the analyses illustrate the influence of crack length on shell buckling instabilities. The experimental and analytical results correlate well.
Author
Numerical Analysis; Nonlinearity; Cylindrical Shells; Aluminum; Thin Walled Shells; Crack Propagation

38
QUALITY ASSURANCE AND RELIABILITY

Includes approaches to, and methods for reliability analysis and control, quality control, inspection, maintainability, and standardization.

20040086654 NASA Langley Research Center, Hampton, VA, USA
Overview of the National Aeronautics and Space Administration's Nondestructive Evaluation (NDE) Program
Generazio, Edward R.; [2002]; 6 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

NASA's Office of Safety and Mission Assurance sponsors an Agency-wide NDE Program that supports Aeronautics and Space Transportation Technology, Human Exploration and Development of Space, Earth Science, and Space Science Enterprises. For each of these Enterprises, safety is the number one priority. Development of the next generation aero-space launch and transportation vehicles, satellites, and deep space probes have highlighted the enabling role that NDE plays in these advanced technology systems. Specific areas of advanced component development, component integrity, and structural heath management are critically supported by NDE technologies. The simultaneous goals of assuring safety, maintaining overall operational efficiency, and developing and utilizing revolutionary technologies to expand human activity and space-based commerce in the frontiers of air and space places increasing demands on the Agencies NDE infrastructure and resources. In this presentation, an overview of NASA's NDE Program will be presented, that includes a background and status of current Enterprise NDE issues, and the NDE investment areas being developed to meet Enterprise safety and mission assurance needs through the year 2009 and beyond.
Author
NASA Programs; Nondestructive Tests; Safety; Space Transportation; Quality Control

20040086890 NASA Ames Research Center, Moffett Field, CA, USA
A Study of Technical Engineering Peer Reviews at NASA
Chao, Lawrence P.; Tumer, Irem Y.; Bell, David G.; November 20, 2003; 53 pp.; In English; No Copyright; Avail: CASI; A04, Hardcopy

This report describes the state of practices of design reviews at NASA and research into what can be done to improve peer review practices. There are many types of reviews at NASA: required and not, formalized and informal, programmatic and technical. Standing project formal reviews such as the Preliminary Design Review and Critical Design Review are a required part of every project and mission development. However, the technical, engineering peer reviews that support teams' work on such projects are informal, some times ad hoc, and inconsistent across the organization. The goal of this work is to identify best practices and lessons learned from NASA's experience, supported by academic research and methodologies to ultimately improve the process. This research has determined that the organization, composition, scope, and approach of the reviews impact their success. Failure Modes and Effects Analysis (FMEA) can identify key areas of concern before or in the reviews. Product definition tools like the Project Priority Matrix, engineering-focused Customer Value Chain Analysis (CVCA), and project or system-based Quality Function Deployment (QFD) help prioritize resources in reviews. The use of information technology and structured design methodologies can strengthen the engineering peer review process to help NASA work towards error-proofing the design process.
Author
Design Analysis; Reviewing; NASA Programs

39
STRUCTURAL MECHANICS

Includes structural element design, analysis and testing; dynamic responses of structures; weight analysis; fatigue and other structural properties; and mechanical and thermal stresses in structures. For applications see *05 Aircraft Design, Testing and Performance*; and *18 Spacecraft Design, Testing and Performance*.

20040086127 Industrial Coll. of the Armed Forces, Washington, DC

Construction

Bewick, Andrew; Boettcher, Mark; Bott, Julian; Condon, William; Eads, Kenneth; Jan. 2002; 26 pp.; In English
Report No.(s): AD-A424434; No Copyright; Avail: CASI; A03, Hardcopy

The construction industry grew at a moderate pace during the last twelve months, in spite of a weakening economy and chronic shortages of skilled and semi-skilled labor. The economic stimulus package adopted in the wake of the September 11th terrorist attacks - notably a series of interest rate reductions - resulted in a sharp increase in housing construction and renovation, offsetting a downward trend in commercial construction. The terrorist attacks also stimulated a renewed interest in applied research and development aimed at improving materials and construction techniques to mitigate the potential damage of future terrorist attacks on American infrastructure. Industry data show evidence of a continuing trend towards consolidation through acquisitions and mergers, forcing smaller construction-related companies to increase their productivity to remain competitive. This trend is driving an accelerated use of information technology tools, particularly at the interface between construction design and scheduling, in an industry-wide effort to improve the efficiency and predictability of project delivery. Finally, as State and local governments find it increasingly difficult to raise revenues to build and maintain needed infrastructure, alternative financing mechanisms involving the private provision of traditionally public services are becoming more widespread. The construction industry demonstrated its resiliency and surge capacity with its yeoman response to the exceptional clean up and reconstruction requirements at the Pentagon and World Trade Center disaster sites. There are no overriding concerns about the readiness of the construction industry to contribute to national security or national mobilization in the event of future conflicts. The industry is generally healthy, moderately profitable, and industry analysts expect continued growth in housing, commercial construction and heavy construction over the medium and long- term.
DTIC
Construction

20040086584 Army Research Lab., Hampton, VA, USA

Influence of Specimen Preparation and Specimen Size on the Transverse Tensile Strength and Scatter of Glass Epoxy Laminates

OBrien, T. Kevin; Chawan, Arun D.; DeMarco, Kevin; [1999]; 10 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

The influence of specimen polishing, specimen configuration, and specimen size on the transverse tension strength of two glass epoxy materials loaded in three and four point bending was evaluated. Polishing machined edges, and/or tension side failure surfaces, was detrimental to specimen strength characterization instead of yielding a higher, more accurate, strength as a result of removing inherent manufacture and handling flaws. Transverse tension strength was sensitive to span length due to the classical weakest link effect. However, strength was less sensitive to volume changes achieved by increasing specimen width. The Weibull scaling law over-predicted changes in transverse tension strengths in three point bend tests and under-predicted changes in transverse tension strengths in four point bend tests. Furthermore, the Weibull slope varied with specimen configuration, volume, and sample size. Hence, the utility of this scaling law for predicting transverse tension strength is unclear.
Author
Bending; Failure; Glass; Laminates; Scale Effect

20040086677 NASA Langley Research Center, Hampton, VA, USA

Advances in Fatigue and Fracture Mechanics Analyses for Aircraft Structures

Newman, J. C., Jr.; [1999]; 40 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

This paper reviews some of the advances that have been made in stress analyses of cracked aircraft components, in the understanding of the fatigue and fatigue-crack growth process, and in the prediction of residual strength of complex aircraft structures with widespread fatigue damage. Finite-element analyses of cracked structures are now used to determine accurate stress-intensity factors for cracks at structural details. Observations of small-crack behavior at open and rivet-loaded holes and the development of small-crack theory has lead to the prediction of stress-life behavior for components with stress concentrations under aircraft spectrum loading. Fatigue-crack growth under simulated aircraft spectra can now be predicted

with the crack-closure concept. Residual strength of cracked panels with severe out-of-plane deformations (buckling) in the presence of stiffeners and multiple-site damage can be predicted with advanced elastic-plastic finite-element analyses and the critical crack-tip-opening angle (CTOA) fracture criterion. These advances are helping to assure continued safety of aircraft structures.
Author
Fatigue (Materials); Fracture Mechanics; Aircraft Structures; Stress Analysis

20040086696 NASA Langley Research Center, Hampton, VA, USA
Inverse FEM for Full-Field Reconstruction of Elastic Deformations in Shear Deformable Plates and Shells
Tessler, Alexander; Spangler, Jan L.; [2004]; 9 pp.; In English; 2nd European Workshop on Structural Health Monitoring, 7-9 Jul. 2004, Munich, Germany
Contract(s)/Grant(s): 23-755-06-00; No Copyright; Avail: CASI; A02, Hardcopy

The inverse problem of real-time reconstruction of full-field structural displacements is addressed through the application of a new variational formulation leading to versatile, robust and computationally efficient inverse shell finite element analysis. Utilizing surface strain measurements from strain sensors mounted on the load-carrying structural components, the methodology enables accurate computations of the three-dimensional displacement field. This high fidelity computational technology is essential for providing feedback to the actuation and control systems of the next generation of aerospace vehicles.
Author
Elastic Deformation; Finite Element Method; Shells (Structural Forms); Cantilever Plates; Shear Strain; Mathematical Models

20040086740 NASA Langley Research Center, Hampton, VA, USA
Prebuckling and Postbuckling Response of Tailored Composite Stiffened Panels with Axial-Shear Coupling
Young, Richard D.; Hyer, Michael W.; Starnes, James H., Jr.; [2000]; 15 pp.; In English
Report No.(s): AIAA Paper 2000-1459; Copyright; Avail: CASI; A03, Hardcopy

Results of a numerical parametric study of the prebuckling and postbuckling response of tailored composite stiffened panels with axial-shear coupling are presented. In the stiffened panels, axial-shear stiffness coupling is created by rotating the stiffener orientation and tailoring the skin laminate anisotropy. The panels are loaded in axial compression and the effects of stiffener orientation and skin anisotropy on the panel stiffness, buckling parameters, and axial-shear coupling response are described. Results are obtained from a nonlinear general shell finite element analysis computer code. The prebuckling and postbuckling responses can be affected by both the stiffener orientation and skin laminate anisotropy, and the effects are different and load dependent. The results help identify different mechanisms for axial-shear coupling, and show that a load-dependent structural response can be controlled by selecting appropriate stiffener and skin parameters.
Derived from text
Composite Structures; Buckling; Panels; Finite Element Method

20040086778 Army Research Lab., Hampton, VA, USA
Analysis and Test of Repair Concepts for a Carbon-Rod Reinforced Laminate
Baker, Donald J.; Rousseau, Carl Q.; [2000]; 10 pp.; In English
Report No.(s): AIAA Paper 2000-1596; Copyright; Avail: CASI; A02, Hardcopy

The use of pultruded carbon-epoxy rods for the reinforcement of composite laminates in some structures results in an efficient structural concept. The results of an analytical and experimental investigation of repair concepts of completely severed carbon-epoxy rods is presented. Three repair concepts are considered: (a) bonded repair with outside moldline and inside moldline doublers; (b) bonded repair with fasteners, and (c) bonded repair with outside moldline doubler only. The stiffness of the repairs was matched with the stiffness of the baseline specimen. The failure strains for the bonded repair with fasteners and the bonded repair with an outside moldline doubler exceeded a target design strain set for the repair concepts.
Author
Epoxy Matrix Composites; Maintenance; Pultrusion; Rods; Graphite-Epoxy Composites

20040086797 NASA Langley Research Center, Hampton, VA, USA
Al-Li Alloy 1441 for Fuselage Applications
Bird, R. K.; Dicus, D. L.; Fridlyander, J. N.; Sandler, V. S.; [2000]; 6 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

A cooperative investigation was conducted to evaluate Al-Cu-Mg-Li alloy 1441 for long service life fuselage applications. Alloy 1441 is currently being used for fuselage applications on the Russian Be-103 amphibious aircraft, and is expected to be used for fuselage skin on a new Tupolev business class aircraft. Alloy 1441 is cold-rollable and has several attributes that make it attractive for fuselage skin applications. These attributes include lower density and higher specific modulus with similar strength as compared to conventional Al-Cu-Mg alloys. Cold-rolled 1441 Al-Li sheet specimens were tested at NASA Langley Research Center (LaRC) and at the All-Russia Institute of Aviation Materials (VIAM) in Russia to evaluate tensile properties, fracture toughness, impact resistance, fatigue life and fatigue crack growth rate. In addition, fuselage panels were fabricated by Tupolev Design Bureau (TDB) using 1441 skins and Al-Zn-Mg-Cu alloy stiffeners. The panels were subjected to cyclic pressurization fatigue tests at TDB and at LaRC to simulate fuselage pressurization/depressurization during aircraft service. This paper discusses the results from this investigation.
Author
Fuselages; Aluminum-Lithium Alloys; Mechanical Properties; Skin (Structural Member); Aluminum Alloys; Lithium Alloys

20040086831 NASA Langley Research Center, Hampton, VA, USA
A New Stochastic Equivalent Linearization Implementation for Prediction of Geometrically Nonlinear Vibrations
Muravyov, Alexander A.; Turner, Travis L.; Robinson, Jay H.; Rizzi, Stephen A.; [1998]; 9 pp.; In English
Report No.(s): AIAA Paper-99-1376; Copyright; Avail: CASI; A02, Hardcopy

In this paper, the problem of random vibration of geometrically nonlinear MDOF structures is considered. The solutions obtained by application of two different versions of a stochastic linearization method are compared with exact (F-P-K) solutions. The formulation of a relatively new version of the stochastic linearization method (energy-based version) is generalized to the MDOF system case. Also, a new method for determination of nonlinear sti ness coefficients for MDOF structures is demonstrated. This method in combination with the equivalent linearization technique is implemented in a new computer program. Results in terms of root-mean-square (RMS) displacements obtained by using the new program and an existing in-house code are compared for two examples of beam-like structures.
Author
Linearization; Nonlinearity; Random Vibration; Stochastic Processes; Beams (Supports)

20040086966 NASA Langley Research Center, Hampton, VA, USA
Residual Strength Analysis Methodology: Laboratory Coupons to Structural Components
Dawicke, D. S.; Newman, J. C., Jr.; Starnes, J. H., Jr.; Rose, C. A.; Young, R. D.; Seshadri, B. R.; [2000]; 28 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

The NASA Aircraft Structural Integrity (NASIP) and Airframe Airworthiness Assurance/Aging Aircraft (AAA/AA) Programs have developed a residual strength prediction methodology for aircraft fuselage structures. This methodology has been experimentally verified for structures ranging from laboratory coupons up to full-scale structural components. The methodology uses the critical crack tip opening angle (CTOA) fracture criterion to characterize the fracture behavior and a material and a geometric nonlinear finite element shell analysis code to perform the structural analyses. The present paper presents the results of a study to evaluate the fracture behavior of 2024-T3 aluminum alloys with thickness of 0.04 inches to 0.09 inches. The critical CTOA and the corresponding plane strain core height necessary to simulate through-the-thickness effects at the crack tip in an otherwise plane stress analysis, were determined from small laboratory specimens. Using these parameters, the CTOA fracture criterion was used to predict the behavior of middle crack tension specimens that were up to 40 inches wide, flat panels with riveted stiffeners and multiple-site damage cracks, 18-inch diameter pressurized cylinders, and full scale curved stiffened panels subjected to internal pressure and mechanical loads.
Author
Aircraft Structures; Residual Strength; Structural Design; NASA Programs; Aircraft Reliability; Fuselages; Fracture Mechanics

20040086967 NASA Langley Research Center, Hampton, VA, USA
Nonlinear Local Bending Response and Bulging Factors for Longitudinal and Circumferential Cracks in Pressurized Cylindrical Shells
Young, Richard D.; Rose, Cheryl A.; Starnes, James H., Jr.; [2000]; 28 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Results of a geometrically nonlinear finite element parametric study to determine curvature correction factors or bulging factors that account for increased stresses due to curvature for longitudinal and circumferential cracks in unstiffened

pressurized cylindrical shells are presented. Geometric parameters varied in the study include the shell radius, the shell wall thickness, and the crack length. The major results are presented in the form of contour plots of the bulging factor as a function of two nondimensional parameters: the shell curvature parameter, lambda, which is a function of the shell geometry, Poisson's ratio, and the crack length; and a loading parameter, eta, which is a function of the shell geometry, material properties, and the applied internal pressure. These plots identify the ranges of the shell curvature and loading parameters for which the effects of geometric nonlinearity are significant. Simple empirical expressions for the bulging factor are then derived from the numerical results and shown to predict accurately the nonlinear response of shells with longitudinal and circumferential cracks. The numerical results are also compared with analytical solutions based on linear shallow shell theory for thin shells, and with some other semi-empirical solutions from the literature, and limitations on the use of these other expressions are suggested.
Author
Bending; Cracks; Cylindrical Shells; Nonlinearity; Bulging; Finite Element Method; Internal Pressure

20040087196 Defence Science and Technology Organisation, Fishermans Bend, Australia
Structural Analyses of a Demonstrator Composite Replacement Panel in a F=lllC Cold Proof Load Test
Harman, Alex B.; Callus, Paul J.; March 2004; 99 pp.; In English
Report No.(s): DSTO-TN-0546; DODA-AR-013-071; Copyright; Avail: Other Sources

The Defence Science and Technology Organization, in collaboration with the Cooperative Research Centre for Advanced Composite Structures, is developing the Composite Replacement Panel Technology (CRPT). The aim of this technology is to replace metallic aircraft structure with that manufactured from advanced composites, thereby reducing support costs and/or increasing capability. The CRPT is being developed through the production of a demonstrator replacement for F-111C Panel 3208, denoted Panel I. It is planned that the design methodology for Panel I (and the analysis described in this report) be validated through the Composite Replacement Panel Strain Survey (CRPSS). In the CRPSS, Panel I will be installed on an F-111C aircraft undergoing a Cold Proof Load Test (CPLT). The CPLT is a static ground test conducted at -40 C that imparts design limit load to critical airframe structure. This report describes the analysis, based on the F-111 Internal Loads Model Revision 1 (December 2002), and tests that predict positive margins-of-safety and no buckling for Panel I, the fasteners and local sub-structure during CPLT loading. It has been accepted by an Australian Defence Force Authorized Engineering Organization (AeroStructures) as satisfactorily addressing the structural requirements for the CRPSS.
Author
Composite Structures; F-111 Aircraft; Load Tests; Replacing; Structural Analysis; Panels; Cold Surfaces

20040087270 NASA Langley Research Center, Hampton, VA, USA
A Novel Four-Node Quadrilateral Smoothing Element for Stress Enhancement and Error Estimation
Tessler, A.; Riggs, H. R.; Dambach, M.; [1998]; 13 pp.; In English
Report No.(s): AIAA Paper 98-1713; No Copyright; Avail: CASI; A03, Hardcopy

A four-node, quadrilateral smoothing element is developed based upon a penalized-discrete-least-squares variational formulation. The smoothing methodology recovers C1-continuous stresses, thus enabling effective a posteriori error estimation and automatic adaptive mesh refinement. The element formulation is originated with a five-node macro-element configuration consisting of four triangular anisoparametric smoothing elements in a cross-diagonal pattern. This element pattern enables a convenient closed-form solution for the degrees of freedom of the interior node, resulting from enforcing explicitly a set of natural edge-wise penalty constraints. The degree-of-freedom reduction scheme leads to a very efficient formulation of a four-node quadrilateral smoothing element without any compromise in robustness and accuracy of the smoothing analysis. The application examples include stress recovery and error estimation in adaptive mesh refinement solutions for an elasticity problem and an aerospace structural component.
Author
Error Analysis; Structural Engineering; Aerospace Systems; Stress Distribution; Grid Refinement (Mathematics)

20040087397 NASA Langley Research Center, Hampton, VA, USA
Behavior of Compression-Loaded Composite Panels with Stringer Terminations and Impact Damage
Jegley, Dawn C.; [1998]; 12 pp.; In English; AIAA/ASME/ASCE/AHS 39th Structures, Structural Dynamics and Materials Conference, 1998, Long Beach, CA, USA
Report No.(s): AIAA Paper 98-1785; Copyright; Avail: CASI; A03, Hardcopy

The results of an analytical and experimental study of graphite-epoxy stiffened panels with impact-damaged stringer

terminations are presented. Five stitched graphite-epoxy panels with stiffeners with a gradual reduction in either thickness or height were examined. Panels were analyzed using finite element analysis and tested by loading them in axial compression to a predetermined load. The panels were then subjected to impact damage and loaded to failure. Axial midplane strains, surface strains, interlaminar strains and failure results are discussed.
Author
Composite Structures; Compression Loads; Graphite-Epoxy Composites; Impact Damage; Panels; Stringers; Commercial Aircraft

20040088182 NASA Langley Research Center, Hampton, VA, USA
Fracture Mechanics Analysis of Stitched Stiffener-Skin Debonding
Glaessgen, E. H.; Raju, I. S.; Poe, C. C., Jr.; [1998]; 15 pp.; In English
Report No.(s): AIAA Paper 98-2022; Copyright; Avail: CASI; A03, Hardcopy

An analysis based on plate finite elements and the virtual crack closure technique has been implemented to study the effect of stitching on mode I and mode II strain energy release rates for debond configurations. The stitches were modeled as discrete nonlinear fastener elements with a compliance determined by experiment. The axial and shear behavior of the stitches was considered, however, the two compliances and failure loads were assumed to be independent. Both a double cantilever beam (mode I) and a mixed mode skin-stiffener debond configuration were studied. In the double cantilever beam configurations, G(sub I) began to decrease once the debond had grown beyond the first row of stitches and was reduced to zero for long debonds. In the mixed-mode skin-stiffener configurations, G(sub I) showed a similar behavior as in the double cantilever beam configurations, however, G(sub u), continued to increase with increasing debond length.
Author
Debonding (Materials); Fracture Mechanics; Skin (Structural Member); Stiffening; Fasteners; Mathematical Models; Aircraft Structures

20040090446 NASA Langley Research Center, Hampton, VA, USA
Effect of Shear Deformation and Continuity on Delamination Modelling with Plate Elements
Glaessgen, E. H.; Riddell, W. T.; Raju, I. S.; [1998]; 18 pp.; In English
Report No.(s): AIAA Paper 98-2023; Copyright; Avail: CASI; A03, Hardcopy

The effects of several critical assumptions and parameters on the computation of strain energy release rates for delamination and debond configurations modeled with plate elements have been quantified. The method of calculation is based on the virtual crack closure technique (VCCT), and models that model the upper and lower surface of the delamination or debond with two-dimensional (2D) plate elements rather than three-dimensional (3D) solid elements. The major advantages of the plate element modeling technique are a smaller model size and simpler geometric modeling. Specific issues that are discussed include: constraint of translational degrees of freedom, rotational degrees of freedom or both in the neighborhood of the crack tip; element order and assumed shear deformation; and continuity of material properties and section stiffness in the vicinity of the debond front, Where appropriate, the plate element analyses are compared with corresponding two-dimensional plane strain analyses.
Author
Delaminating; Plates (Structural Members); Shear Properties; Skin (Structural Member); Deformation; Continuity; Two Dimensional Models

42
GEOSCIENCES (GENERAL)

Includes general research topics related to the Earth sciences, and the specific areas of petrology, mineralogy, and general geology. For other specific topics in geosciences see *categories 42 through 48*.

20040095315 Georgia Inst. of Tech., Atlanta, GA, USA
Tropospheric Modeling Studies of TRACE-P Data: Investigations of the HO(x)/NO(x)/O3 Photochemical System and Its Coupling to Sulfur/Aerosol Species
Davis, Douglas D.; [2003]; 3 pp.; In English
Contract(s)/Grant(s): NCC1-0124; No Copyright; Avail: CASI; A01, Hardcopy

During the duration of the NASA Grant NCC1-01-24, members of research team consisted of: D. Davis, G. Chen, S. Liu, C. Song, B. DiNunno, J. Nowak, and X. Gong. The major goal of our group effort was that of analyzing data from several

NASA field studies and then preparing manuscripts for publication reflecting these analyses. Many of the papers so published were initiated by members of the Davis group; however, for a great many others one or more group members assisted other PI'S in writing their manuscripts. Both types of manuscripts are listed below as representing the final product from this grant.
Author
Troposphere; Atmospheric Models; Hydrogen Compounds; Nitrogen Compounds

43
EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth features, phenomena and resources by aircraft, balloon, rocket, and spacecraft; analysis of remote sensing data and imagery; development of remote sensing products; photogrammetry; and aerial photography. For related instrumentation see *35 Instrumentation and Photography*.

20040086279 Naval Postgraduate School, Monterey, CA
Calibration and Validation of High Frequency Radar for Ocean Surface Current Mapping
Kim, Kyung C.; Jun. 2004; 92 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424757; No Copyright; Avail: CASI; A05, Hardcopy

High Frequency (HF) radar backscatter instruments are being developed and tested in the marine science and defense science communities for their abilities to sense surface parameters remotely in the coastal ocean over large areas. In the Navy context, the systems provide real-time mapping of ocean surface currents and waves critical for characterizing and forecasting the battle space environment.
DTIC
Backscattering; Calibrating; High Frequencies; Ocean Currents; Ocean Surface

20040086575 NASA Langley Research Center, Hampton, VA, USA
Surface Emissivity Maps for Satellite Retrieval of the Longwave Radiation Budget
Gupta, Shashi K.; Wilber, Anne C.; Kratz, David P.; [1999]; 4 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

This paper presents a brief description of the procedure used to produce global surface emissivity maps for the broadband LW, the 8-12 micrometer window, and 12 narrow LW bands. For a detailed description of the methodology and the input data, the reader is referred to Wilber et al. (1999). These maps are based on a time-independent surface type map published by the IGBP, and laboratory measurements of spectral reflectances of surface materials. These maps represent a first attempt to characterize emissivity based on surface types, and many improvements to the methodology presented here are already underway. Effects of viewing zenith angle and sea state on the emissivity of ocean surface (Smith et al. 1996, Wu and Smith 1997, Masuda et al. 1988) will be taken into account. Measurements form ASTER and MODIS will be incorporated as they become available. Seasonal variation of emissivity based on changes in the characteristics of vegetation will be considered, and the variability of emissivity of barren land areas will be accounted for with the use of Zobler World Soil Maps (Zobler 1986). The current maps have been made available to the scientific community from the web site: http://tanalo.larc.nasa.gov:8080/surf_htmls/ SARB_surf.html
Derived from text
Emissivity; Long Wave Radiation; Thematic Mapping; Surface Geometry

20040086581 NASA Langley Research Center, Hampton, VA, USA
Combining Satellite Data, Trajectory Modeling and Surface Insolation Measurements to Deduce the Direct Radiative Effect of Smoke Aerosol
Stackhouse, Paul W., Jr.; Pierce, R. Bradley; Baum, Bryan A.; DiPasquale, Robert C.; January 2004; 4 pp.; In English
Report No.(s): NASA-99-10AMS-PWS; No Copyright; Avail: CASI; A01, Hardcopy

In this paper, we have introduced a method of inferring the radiative effect of smoke aerosols using a technique that combines satellite remote sensing with trajectory modeling. The results shown here clearly show large flux biases between theoretical and measured radiative fluxes correlate with the arrival of smoke aerosol to the area. Further analysis is required to convincingly demonstrate that the reason for these differences is the radiative effect of the smoke aerosols. To do this, the estimated fluxes taken from the ERA-15 will be recomputed every 3 hours using International Satellite Cloud Climatology Project (ISCCP) data set entitled DX gridded to a 1o equal angle resolution (see paper 7B.2 for details). Surface radiometric and ancillary data for several more Canadian surface sites are being obtained at minute temporal resolution. The ultimate purpose of this research is to derive aerosol smoke maps for fire events such as this to be included in an aerosol climatology

and be incorporated in the computation of the earth's surface radiation budget to better understand the radiative effect of aerosols.
Derived from text
Aerosols; Insolation; Smoke; Remote Sensing; Earth Surface; Satellite Observation; Mathematical Models; Climatology

20040086916 NASA Ames Research Center, Moffett Field, CA, USA
A New Computational Framework for Atmospheric and Surface Remote Sensing
Timucin, Dogan A.; June 14, 2004; 7 pp.; In English; NASA Earth Science Technology Conference, 24 Jun. 2004, Palo Alto, CA, USA
Report No.(s): Rept-1; No Copyright; Avail: CASI; A02, Hardcopy

A Bayesian data-analysis framework is described for atmospheric and surface retrievals from remotely-sensed hyper-spectral data. Some computational techniques are high- lighted for improved accuracy in the forward physics model.
Author
Bayes Theorem; Remote Sensing; Atmospheric Sounding; Emission Spectra

20040087103 NASA Ames Research Center, Moffett Field, CA, USA
Recent History of Large-Scale Ecosystem Disturbances in North America Derived from the AVHRR Satellite Record
Potter, Christopher; Tan, Pang-Ning; Kumar, Vipin; Kicharik, Chris; Klooster, Steven; Genovese, Vanessa; March 20, 2004; 1 pp.; In English
Contract(s)/Grant(s): RTOP 622-94-12-10; No Copyright; Avail: Other Sources; Abstract Only

Ecosystem structure and function are strongly impacted by disturbance events, many of which in North America are associated with seasonal temperature extremes, wildfires, and tropical storms. This study was conducted to evaluate patterns in a 19-year record of global satellite observations of vegetation phenology from the Advanced Very High Resolution Radiometer (AVHRR) as a means to characterize major ecosystem disturbance events and regimes. The fraction absorbed of photosynthetically active radiation (FPAR) by vegetation canopies worldwide has been computed at a monthly time interval from 1982 to 2000 and gridded at a spatial resolution of 8-km globally. Potential disturbance events were identified in the FPAR time series by locating anomalously low values (FPAR-LO) that lasted longer than 12 consecutive months at any 8-km pixel. We can find verifiable evidence of numerous disturbance types across North America, including major regional patterns of cold and heat waves, forest fires, tropical storms, and large-scale forest logging. Summed over 19 years, areas potentially influenced by major ecosystem disturbances (one FPAR-LO event over the period 1982-2000) total to more than 766,000 km2. The periods of highest detection frequency were 1987-1989, 1995-1997, and 1999. Sub- continental regions of Alaska and Central Canada had the highest proportion (greater than 90%) of FPAR-LO pixels detected in forests, tundra shrublands, and wetland areas. The Great Lakes region showed the highest proportion (39%) of FPAR-LO pixels detected in cropland areas, whereas the western USA showed the highest proportion (16%) of FPAR-LO pixels detected in grassland areas. Based on this analysis, an historical picture is emerging of periodic droughts and heat waves, possibly coupled with herbivorous insect outbreaks, as among the most important causes of ecosystem disturbance in North America.
Author
Advanced Very High Resolution Radiometer; Ecosystems; Histories; North America; Time Series Analysis; Phenology; Canopies (Vegetation)

20040095305 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Validation of SCIAMACHY and TOMS UV Radiances Using Ground and Space Observations
Hilsenrath, E.; Bhartia, P. K.; Bojkov, B. R.; Kowalewski, M.; Labow, G.; Ahmad, Z.; [2004]; 1 pp.; In English; International Quadrennial Ozone Symposium (QOS 2004), 1-8 Jun. 2004, Kos, Greece; No Copyright; Avail: Other Sources; Abstract Only

Verification of a stratospheric ozone recovery remains a high priority for environmental research and policy definition. Models predict an ozone recovery at a much lower rate than the measured depletion rate observed to date. Therefore improved precision of the satellite and ground ozone observing systems are required over the long term to verify its recovery. We show that validation of satellite radiances from space and from the ground can be a very effective means for correcting long term drifts of backscatter type satellite measurements and can be used to cross calibrate all B W instruments in orbit (TOMS, SBW/2, GOME, SCIAMACHY, OM, GOME-2, OMPS). This method bypasses the retrieval algorithms used for both satellite and ground based measurements that are normally used to validate and correct the satellite data. Radiance comparisons employ forward models and are inherently more accurate than inverse (retrieval) algorithms. This approach however requires well calibrated instruments and an accurate radiative transfer model that accounts for aerosols. TOMS and SCIAMACHY

calibrations are checked to demonstrate this method and to demonstrate applicability for long term trends.
Author
Satellite Observation; Total Ozone Mapping Spectrometer; Ultraviolet Radiation; Space Observations (From Earth); Stratosphere

44
ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; and solar, geothermal, windpower, and waterwave conversion systems; energy storage; and traditional power generators. For technologies related to nuclear energy production see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power; 20 Spacecraft Propulsion and Power*, and *28 Propellants and Fuels*.

20040086246 Naval Postgraduate School, Monterey, CA
Russia's National Interests Towards the Caucasus: Implications for Georgian Sovereignty
Papava, David A.; Jun. 2004; 101 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424691; No Copyright; Avail: CASI; A06, Hardcopy

This thesis explores the causes of Russian foreign policy towards Georgia. It argues that the Russian Federation continues to pursue a policy which weakens the sovereignty of the Caucasus. The main priority of this thesis is to identify why the Russian Federation seems to be pursuing a set of policies that economically and politically weaken the sovereignty of Georgia. Therefore, this thesis examines the forces and factors of Russian domestic politics that drive Russian national interests towards the Caucasus. The analysis focuses on one particular issue-area: the role of the economic elite in shaping Russiass domestic and foreign policies vis-a- vis the state in the electricity sector. In focusing on the energy policies of the Russian Federation, this thesis reveals the negative consequences for Georgia's sovereignty that result from a strong Russian influence in the region. This thesis analyzes how Russian national interests towards Georgia challenge the latter to establish autonomous decisionmaking with regard to its foreign policy and to exercise its own authority through an exclusive competence in internal affairs of the state. In conclusion, this thesis offers policy prescriptions on how Georgia might best preserve its sovereignty with respect to the Russian Federation in terms of energy dependency.
DTIC
Foreign Policy; Russian Federation; Sovereignty

20040086278 Texas A&M Univ., College Station, TX
Highly-Compact SMA Actuators A Feasibiltiy Study of Fuel-Powered and Thermoelectric SMA Actuators
Lagoudas, D. C.; Rediniotis, O. K.; Dec. 2003; 14 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424753; ARO-42978.1-EG; No Copyright; Avail: CASI; A03, Hardcopy

In this work, a compact fuel-powered (FPC) SMA actuator and a compact thermoelectric (TEC) SMA actuator has been designed, fabricated and tested. An FPC-SMA actuator system has been developed utilizing high energy density of fuels. The final FPC-SMA actuator system is composed of an SMA strip, two pumps, valves, two bellows, a multi-channel combustor/heat exchanger, a micro-tube heat exchanger (radiator) and a control unit. The SMA Strip is embedded in a rectangular channel. This channel also contains a rectangular piston with a slot, such that the piston can move along the SMA strip and prevent mixing between the hot and cold fluids. The final FPC-SMA system can generate 250 N force of 2.0 % strain at 1.0 Hz actuation frequency under closed-loop test conditions. The second actuator is a solid-state, compact, TEC- SMA actuator utilizing the thermoelectric effect. The TEC-SMA system is currently able to produce lOOMPa stress with 1.5% strain under 0.5Hz actuation frequency. Work on the TEC- SMA actuator includes development of a basic experimental setup to characterize and optimize actuator bandwidth, stroke, output power and energy density. Design and development of a fixture for improved contact between the SMA and the thermoelectric elements and a test matrix for evaluation of actuator bandwidth, stroke, power and energy densities with respect to commercially available TE modules. This feasibility study shows that to further optimize both the power density and efficiency of the TEC-SMA actuator, SMA surface area to volume ratio needs to be increased while maintaining heat sinks at low temperatures and minimizing contact resistances.
DTIC
Actuators; Combustion Chambers; Shape Memory Alloys; Thermoelectric Power Generation; Thermoelectricity

20040086659 Southern Univ., Baton Rouge, LA, USA
Preparation and Characterization of Solid Electrolytes: Fuel Cell Applications
Bobba, R.; Hormes, J.; Wang, T.; Baker, J. A.; Prier, D. G.; 2003; 146 pp.; In English
Report No.(s): DE2004-822042; No Copyright; Avail: Department of Energy Information Bridge

The intent of this project with Federal Energy Technology Center (FETC)/Morgantown Energy Technology Center (METC) is to develop research infrastructure conductive to Fuel Cell research at Southern University and A and M College, Baton Route. A state of the art research laboratory (James Hall No.123 and No.114) for energy conversion and storage devices was developed during this project duration. The Solid State Ionics laboratory is now fully equipped with materials research instruments: Arbin Battery Cycling and testing (8 channel) unit, Electrochemical Analyzer (EG and G PAR Model 273 and Solartron AC impedance analyzer), Fuel Cell test station (Globe Tech), Differential Scanning Calorimeter (DSC-10), Thermogravimetric Analyzer (TGA), Scanning Tunneling Microscope (STM), UV-VIS-NIR Absorption Spectrometer, Fluorescence Spectrometer, FT-IR Spectrometer, Extended X-ray Absorption Fine Structure (EXAFS) measurement capability at Center for Advanced Microstructure and Devices (CAMD - a multimillion dollar DOE facility), Glove Box, gas hood chamber, high temperature furnaces, hydraulic press and several high performance computers. IN particular, a high temperature furnace (Thermodyne 6000 furnace) and a high temperature oven were acquired through this project funds. The PI Dr. R Bobba has acquired additional funds from federal agencies include NSF-Academic Research Infrastructure program and other DOE sites. They have extensively used the multimillion dollar DOE facility ''Center'' for Advanced Microstructures and Devices (CAMD) for electrochemical research. The students were heavily involved in the experimental EXAFS measurements and made use of their DCM beamline for EXAFS research. The primary objective was to provide hands on experience to the selected African American undergraduate and graduate students in experimental energy research. The goal was to develop research skills and involve them in the Preparation and Characterization of Solid Electrolytes. Ionically conducting solid electrolytes are successfully used for battery, fuel cell and sensor applications.
NTIS
Electrolytic Cells; Fuel Cells; Solid Electrolytes; Energy Technology; Energy Conversion

20040087381 National Renewable Energy Lab., Golden, CO, Texas Technological Univ., Lubbock, TX, USA
Research in Hydrogen Passivation of Defects and Impurities in Silicon
Estreicher, S. K.; 2003; In English
Report No.(s): DE2003-15004721; NREL/SR-520-34818; No Copyright; Avail: National Technical Information Service (NTIS)

The objective of the research under this contract is to perform systematic first-principles calculations on native defects and selected transition metal impurities in Si and their interactions with hydrogen. One goal is to gain insight into which defects need to be passivated and which ones do not, which defects are the most stable, and how interactions with H affect their electrical and optical properties. This work includes potential surface and electronic structure calculations, as well as real-time, constant-temperature, molecular dynamic simulations to test the thermal stability of various defects and monitor defect reactions and/or diffusion.
NTIS
Silicon; Hydrogen; Defects

20040088852 National Renewable Energy Lab., Golden, CO
Heat Transfer Analysis and Modeling of a Parabolic Trough Solar Receiver Implemented in Engineering Equation Solver
Forristall, R.; 2003; In English
Report No.(s): DE2003-15004820; NREL/TP-550-34169; No Copyright; Avail: National Technical Information Service (NTIS)

This report describes the development, validation, and use of a heat transfer model implemented in Engineering Equation Solver. The model determines the performance of a parabolic trough solar collector's linear receiver, also called a heat collector element. All heat transfer and thermodynamic equations, optical properties, and parameters used in the model are discussed. The modeling assumptions and limitations are also discussed, along with recommendations for model improvement
NTIS
Heat Transfer; Solar Collectors; Thermodynamic Properties; Parabolic Reflectors

Includes atmospheric, water, soil, noise, and thermal pollution.

20040086637 Office of Air Quality Planning and Standards, Research Triangle Park, NC
Benefit Analysis for the Section 112 Utility Rule
Jan. 2004; 68 pp.; In English
Report No.(s): PB2004-106644; EPA-452/R-03-021; No Copyright; Avail: CASI; A04, Hardcopy

The emission reductions achieved by the proposed action to reduce mercury and nickel emissions under CAA Section 111 or 112 will provide benefits to society by improving environmental quality. In this section, and the following section, information is provided on the types and levels of social benefits anticipated from the proposed action. This section discusses the health and welfare effects associated with mercury, nickel and other pollutants emitted by affected fossil-fuel fired electric utility steam generating units. The following section quantifies and places a monetary value on a portion of the benefits that are described here.
NTIS
Contaminants; Environmental Quality

20040086638 Office of Air Quality Planning and Standards, Research Triangle Park, NC
Regulatory Impact Analysis for the Plywood and Composite Wood Products NESHAP
Feb. 2004; In English
Report No.(s): PB2004-106643; EPA-452/R-04-005; No Copyright; Avail: National Technical Information Service (NTIS)

Under the authority of Section 112(d) of the Clean Air Act as amended in 1990, the U.S. Environmental Protection Agency (EPA or the Agency) is a regulation requiring facilities that manufacture plywood and composite wood products to reduce their emissions of hazardous air pollutants (HAPs). This regulation, a National Emission Standard for Hazardous Air Pollutants (NESHAP), will apply to major sources of HAPs in this industry. This regulatory impact analysis (RIA) presents the supporting documentation and analyses developed by the Agency that describe and quantify the expected impacts of the Plywood and Composite Wood Products NESHAP.
NTIS
Air Pollution; Plywood; Environment Protection

20040086639
Follow Up Evaluation of Design Changes to a Houseboat Generator Exhaust Stack System
Hammond, D. R.; Marlow, D. A.; Jul. 2004; 14 pp.; In English
Report No.(s): PB2004-106473; EPHB-171-34A2; No Copyright; Avail: CASI; A03, Hardcopy

On April 27th, 2004, National Institute for Occupational Safety and Health (NIOSH) researchers conducted a follow-up evaluation of an exhaust stack designed to reduce carbon monoxide (CO) emissions and prevent exposures on houseboats at Sumerset Acquisitions LLC in Somerset, Kentucky. This work was conducted to evaluate permanent design changes that were made to the Sumerset stack since the August 2003 CO evaluation documented in the NIOSH report titled, ‘An evaluation of factors that might influence stack performance to prevent carbon monoxide poisonings from houseboat generator exhaust.’ Although the exhaust stacks evaluated during the August 2003 NIOSH study performed well, the initial design included several factors that influenced the stack performance. This report provides a brief description of the design changes, methods, results, and conclusions from the follow-up evaluation.
NTIS
Carbon Monoxide; Exhaust Gases; Exhaust Systems

20040086645 Research Triangle Inst., Research Triangle Park, NC
Taconite Iron Ore NESHAP Economic Impact Analysis
Heller, K.; Depro, B. M.; Yang, J. C.; Clayton, L.; Aug. 2003; 96 pp.; In English
Report No.(s): PB2004-106212; EPA-452/R-03-015; No Copyright; Avail: CASI; A05, Hardcopy

Under Section 112 of the Clean Air Act (the Act), the U. S. Environmental Protection Agency (EPA) is developing national emission standards for hazardous air pollutants (NESHAP) for the taconite processing source category. Taconite processing involves separating and concentrating iron ore as well as creating and indurating (hardening) pellets. Taconite production in the USA is concentrated in a few counties in Minnesota and Michigan. To better control emissions of hazardous

air pollutants (HAPs) during these processes, EPA expects that additional emission control equipment will be installed for indurating furnaces and other part of the operation, such as onsite crushing and handling and pellet handling.
NTIS
Air Pollution; Air Quality; Environment Protection

20040086646 Naval Surface Warfare Center, Bethesda, MD, USA
Glacier Bay Watercraft Noise
Kipple, B.; Gabriele, C.; Feb. 2003; In English
Report No.(s): PB2004-106210; No Copyright; Avail: National Technical Information Service (NTIS)

Underwater noise levels of 14 vessels operated by Glacier Bay National Park and Preserve were measured in 2000 and 2002. The vessels tested were from 14 to 65 feet in length and engine power ratings ranged from 25 to 420 horsepower. Most boats were evaluated at speeds of 10, 14, and 20 knots. These watercraft generated peak one-third octave noise levels ranging from 150 to 177 dB re 1 microPa at 1 yard and sound levels from 157 to 181 dB re 1 microPa at 1 yard. Noise levels depended on vessel type.
NTIS
Glaciers; Horsepower; Noise Intensity

20040086647 Office of Air Quality Planning and Standards, Research Triangle Park, NC
Ozone Report: Measuring Progress through 2003
Apr. 2004; In English
Report No.(s): PB2004-106209; EPA-454/K04-001; No Copyright; Avail: National Technical Information Service (NTIS)

In 2003, ozone levels nationwide were the lowest they have been since 1980. Yet ozone continues to be a pervasive air pollution problem, affecting many areas across the country and, at times, harming millions of people, sensitive vegetation, and ecosystems. This report analyzes ozone levels in 2003, summarizes the progress we have made in reducing levels of ozone since 1980, investigates how we have made progress, and looks at our current challenges and long-term prospects for continuing to reduce ground-level ozone. This report does not provide all of the answers, but may bring us closer to understanding the ozone problem, including the links between emission reduction programs, changes in emissions and meteorology, and ozone air quality.
NTIS
Air Pollution; Ecosystems; Ozone

20040086656 Carnegie-Mellon Univ., Pittsburgh, PA, USA
Sampling, Analysis, and Properties of Primary PM-2.5: Application to Coal-fired Utility Boilers
Robinson, A. L.; Pandis, S. N.; Lipsky, E.; Stanier, C.; Anderson, N.; Feb. 2003; In English
Report No.(s): DE2004-822106; No Copyright; Avail: National Technical Information Service (NTIS)

A dilution sampler was used to examine the effects of dilution ratio and residence time on the particulate emissions from a pilot-scale pulverized coal combustor. Measurements include the particle size distribution from 0.003 to 2.5 (micro) m, PM(sub 2.5) mass emission rate and PM2.5 composition (OC/EC, major ions, and elemental). Hot filter samples were also collected simultaneously in order to compare the dilution sampler measurement with standard stack sampling methodologies such as EPA Method 5. Measurements were made both before and after the bag-house, the particle control device used on the coal combustor. Measurements were made with three different coal types and a coal-biomass blend.
NTIS
Boilers; Coal; Combustion Chambers

20040087193 NASA Langley Research Center, Hampton, VA, USA
Comparison of Satellite Observations of Aerosol Optical Depth to Surface Monitor Fine Particle Concentration
Kleb, Mary M.; AlSaadi, Jassim A.; Neil, Doreen O.; Pierce, Robert B.; Pippin, Margartet R.; Roell, Marilee M.; Kittaka, Chieko; Szykman, James J.; July 7, 2004; 278 pp.; In English
Contract(s)/Grant(s): 613-23-01
Report No.(s): NASA/TM-2004-213248; L-19039; No Copyright; Avail: CASI; A13, Hardcopy

Under NASA's Earth Science Applications Program, the Infusing satellite Data into Environmental Applications (IDEA) project examined the relationship between satellite observations and surface monitors of air pollutants to facilitate a more capable and integrated observing network. This report provides a comparison of satellite aerosol optical depth to surface

monitor fine particle concentration observations for the month of September 2003 at more than 300 individual locations in the continental US. During September 2003, IDEA provided prototype, near real-time data-fusion products to the Environmental Protection Agency (EPA) directed toward improving the accuracy of EPA s next-day Air Quality Index (AQI) forecasts. Researchers from NASA Langley Research Center and EPA used data from the Moderate Resolution Imaging Spectroradiometer (MODIS) instrument combined with EPA ground network data to create a NASA-data-enhanced Forecast Tool. Air quality forecasters used this tool to prepare their forecasts of particle pollution, or particulate matter less than 2.5 microns in diameter (PM2.5), for the next-day AQI. The archived data provide a rich resource for further studies and analysis. The IDEA project uses data sets and models developed for tropospheric chemistry research to assist federal, state, and local agencies in making decisions concerning air quality management to protect public health.
Author
Aerosols; Earth Sciences; Monitors; Optical Thickness; Particulates; Satellite Observation

20040087326 National Inst. for Occupational Safety and Health, Pittsburgh, PA, USA
Performance of a New Personal Respirable Dust Monitor for Mine Use
Volkwein, J. C.; Vinson, R. P.; McWilliams, L. J.; Tuchman, D. P.; Mischler, S. E.; Jun. 2004; 30 pp.; In English
Report No.(s): PB2004-106656; DHHS/NIOSH/PUB-2004-151; RI-9663; No Copyright; Avail: CASI; A03, Hardcopy

A personal dust monitor (PDM) was developed to measure respirable coal mine dust mass to provide accurate exposure data at the end of a work shift. Additionally, the new monitor continuously displays near-real-time dust exposure data during the shift. Under specific test conditions, the PDM demonstrated that it was convenient to wear, robust, provided accurate data, provided timely data that could be used to prevent overexposure, and was easy to use.
NTIS
Dust; Display Devices; Coal

20040087334 ENVIRON International Corp., Novato, CA
Analysis of EPA's Draft Plan for Emissions Modeling on MOVES (Motor Vehicle Emission Simulator) and MOVES GHG (Greenhouse Gas Model)
Lindhjem, C. E.; Pollack, A. K.; May 2004; In English
Report No.(s): PB2004-106728; No Copyright; Avail: National Technical Information Service (NTIS)

EPA has proposed a new modeling method for on-road vehicle emissions called the Motor Vehicle Emission Simulator (MOVES). The initial release of the MOVES model is scheduled for mid-2004; this version, called MOVE GHG, will address only greenhouse gas emissions, which are primarily due to fuel consumption. This report reviews the overall MOVES model design and the approach to be implemented in MOVES GHG using the publicly available information and presentations provided by EPA through the end of 2003. This study consisted of three main tasks: (1) a review of the overall MOVES approach for on-road vehicles; (2) a review of specific issues related to the modeling of greenhouse gases; and (3) a review of the portable emission monitoring system (PEMS), an innovative in-situ emission measurement method to be used in gathering future emissions data for MOVES.
NTIS
Exhaust Emission; Motor Vehicles

20040087350 Environmental Protection Agency, Research Triangle Park, NC
Evaluation of an Annual Simulation of Ozone and Fine Particulate Matter Over the Continental USA: Which Temporal Features are Captured
Hogrefe, C.; Jones, J. M.; Gilliland, A.; Porter, P. S.; Gego, E.; 2004; 10 pp.; In English
Report No.(s): PB2004-106731; EPA/600/A-04/075; No Copyright; Avail: CASI; A02, Hardcopy

No abstract available
Ozone; Simulation; Evaluation; Particulate Reinforced Composites

20040090441 California Inst. of Tech., Pasadena, CA
Development of On-line Instrumentation and Techniques to Detect and Measure Particulates. Quarterly Technical Progress Report from October 1, 2002 to January 28, 2003
Wu, S.; Palm, S.; Tang, Y.; Goddard, W. A.; 2003; In English
Report No.(s): DE2003-816712; No Copyright; Avail: National Technical Information Service (NTIS)

In the first quarter of the project, we reviewed many past references about using light scattering to characterize particulate

matters. We also constructed light sources, detection systems and PM synthesizer for the project.
NTIS
Particulates; Synthesizers; On-Line Systems

20040090443 State Univ. of New York at Buffalo, Amherst, NY, USA
Field Test Program For Long-Term Operation of a COHPAC System for Removing Mercury from Coal-Fired Flue Gas
Bustard, J.; Lindsey, C.; 2003; In English
Report No.(s): DE2003-816716; No Copyright; Avail: National Technical Information Service (NTIS)

With the Nation's coal-burning utilities facing the possibility of tighter controls on mercury pollutants, the U.S. Department of Energy is funding projects that could offer power plant operators better ways to reduce these emissions at much lower costs. Sorbent injection technology represents one of the simplest and most mature approaches to controlling mercury emissions from coal-fired boilers. It involves injecting a solid material such as powdered activated carbon into the flue gas. The gas phase mercury in the flue gas contacts the sorbent and attaches to its surface. The sorbent with the mercury attached is then collected by the existing particle control device along with the other solid material, primarily fly ash.
NTIS
Flue Gases; Fly Ash; Activated Carbon; Boilers

46
GEOPHYSICS

Includes Earth structure and dynamics, aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For related information see *47 Meteorology and Climatology*; and *93 Space Radiation*.

20040086102 Air Force Research Lab., Hanscom AFB, MA
Water Vapor Retrieval Using the FLAASH Atmospheric Correction Algorithm
Felde, Gerald W.; Anderson, Gail P.; Gardner, James A.; Alder-Golden, Stephen M.; Matthew, Michael W.; Apr. 16, 2004; 12 pp.; In English
Contract(s)/Grant(s): Proj-1010
Report No.(s): AD-A423120; AFRL-VS-HA-TR-2004-1071; No Copyright; Avail: CASI; A03, Hardcopy

FLAASH (Fast Line-of-Sight Atmospheric Analysis of Spectral Hypercubes) is a first-principles atmospheric correction algorithm for visible to shortwave infrared (SWIR) hyperspectral data. The algorithm consists of two main steps. The first is retrieval of atmospheric parameters, visibility (which is related to the aerosol type and distribution) and column water vapor. The second step is solving the radiation transport equation for the given aerosol and column water and transformation to surface reflectance. The focus of this paper is on the FLAASH water vapor retrieval algorithm. Modeled radiance values in the spectral region of one water vapor absorption feature are calculated from MODTRAN 4 using several different water vapor amounts and are used to generate a Look- Up Table (LUT). The water band typically used is 1130 nm but either the 940 or 820 nm band may also be used. Measured radiance values - are compared to the LUT to determine the column water vapor amount for each pixel in the scene. We compare the results of water retrievals for each of these bands and also the results of their corresponding reflectance retrievals.
DTIC
Algorithms; Atmospheric Correction; Atmospheric Physics; Water Vapor

20040086110 Massachusetts Univ., Lowell, MA
Imaging and Forecasting of Ionospheric Structures and Their System Impacts
Reinisch, Bodo; Sales, Gary; Dec. 5, 2004; 35 pp.; In English
Contract(s)/Grant(s): F19628-02-C-0092; Proj-2311
Report No.(s): AD-A424402; AFRL-VS-HA-TR-2004-1037; No Copyright; Avail: CASI; A03, Hardcopy

The coordinated South American ionospheric measurement campaign, COPEX was held from October through December, 2002. Analysis of the sounder data from the equatorial site at Cachimbo, Brazil reinforced the general understanding of the difficulty in predicting the onset of spread F on any particular night Measurement of sporadic E formation at the magnetic field footprint in the anomaly regions provided no insight into the spread F formation problem. RPI/ IMAGE reception of groundbased VLF transmissions in space over a period of two years was used to determine the efficiency for generating whistler mode waves that propagate along the magnetic field to the satellite. These results are compared with AFRL ray tracing simulations. Extensive analysis was carried out on the use of VLF/LF transmissions from a space platform to

interact with high energy trapped electrons in the plasmasphere and scatter them so that they cannot cause damage to low earth orbiting satellites.
DTIC
F Region; Forecasting; Imaging Techniques; Magnetic Fields; Plasmasphere; Ray Tracing; Whistlers

20040086547 Prairie View Agricultural and Mechanical Coll., TX, USA
Substorm Evolution in the Near-Earth Plasma Sheet
Erickson, Gary M.; [2004]; 3 pp.; In English
Contract(s)/Grant(s): NAG5-13412; No Copyright; Avail: CASI; A01, Hardcopy

This grant represented one-year, phase-out funding for the project of the same name (NAG5-9110 to Boston University) to determine precursors and signatures of local substorm onset and how they evolve in the plasma sheet using the Geotail near-Earth database. We report here on two accomplishments: (1) Completion of an examination of plasma velocity signature at times of local onsets in the current disruption (CD) region. (2) Initial investigation into quantification of near-Earth flux-tube contents of injected plasma at times of substorm injections.
Author
Magnetic Storms; Plasma Layers; Space Weather

20040086559 Cornell Univ., Ithaca, NY, USA
Dynamics of Aerosol Particles in Stationary, Isotropic Turbulence
Collins, Lance R.; Meng, Hui; August 10, 2004; 9 pp.; In English
Contract(s)/Grant(s): NAG3-2470; No Copyright; Avail: CASI; A02, Hardcopy

A detailed study of the dynamics of sub-Kolmogorov-size aerosol particles in stationary isotropic turbulence has been performed. The study combined direct numerical simulations (DNS; directed by Prof. Collins) and high-resolution experimental measurements (directed by Prof. Meng) under conditions of nearly perfect geometric and parametric overlap. The goal was to measure the accumulation of particles in low-vorticity regions of the flow that arises from the effect commonly referred to as preferential concentration. The grant technically was initiated on June 13, 2000; however, funding was not available until July 11, 2000. The grant was originally awarded to Penn State University (numerical simulations) and SUNY-Buffalo (experiments); however, Prof. Collins effort was moved to Cornell University on January 2002 when he joined that university. He completed the study there. A list of the specific tasks that were completed under this study is presented.
Derived from text
Aerosols; Isotropic Turbulence; Dynamics; Direct Numerical Simulation

20040086582 NASA Langley Research Center, Hampton, VA, USA
The WCRP/GEWEX Surface Radiation Budget Project Release 2: First Results at 1 Degree Resolution
Stackhouse, Paul W., Jr.; Cox, Stephen J.; Gupta, Shashi K.; DiPasquale, Roberta C.; Brown, Donald E.; [1999]; 4 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The earth s surface radiative budget in the solar wavelengths (i.e., shortwave) and thermal infrared wavelengths (i.e., longwave) is an important component of Earth s global energy balance and climate. As such, it was identified as a priority need by the World Climate Research Programme (WCRP) and thus a program was instituted at NASA to estimate the radiative flux quantities at the surface from space observations. The Surface Radiation Budget (SRB) Project was created and later included as a component of the Global Energy and Water Cycle Experiment (GEWEX) under the auspices of the WCRP.
Derived from text
Atmospheric Radiation; Infrared Spectra; Energy Budgets

20040086880 NASA Langley Research Center, Hampton, VA, USA
The WCRP/GEWEX Surface Radiation Budget Project Release 2: An Assessment of Surface Fluxes at 1 Degree Resolution
Stackhouse, P. W., Jr.; Gupta, S. K.; Cox, S. J.; Chiacchio, M.; Mikovitz, J. C.; [2004]; 4 pp.; In English
Contract(s)/Grant(s): NRA-99-OES-04
Report No.(s): NASA-2000-IRS-PWS; No Copyright; Avail: CASI; A01, Hardcopy

The U.S. National Aeronautics and Space Administration (NASA) based Surface Radiation Budget (SRB) Project in association with the World Climate Research Programme Global Energy and Water Cycle Experiment (WCRP/GEWEX) is preparing a new 1 deg x 1 deg horizontal resolution product for distribution scheduled for release in early 2001. The new

release contains several significant upgrades from the previous version. This paper summarizes the most significant upgrades and presents validation results as an assessment of the new data set.
Author
NASA Programs; Atmospheric Radiation; Climate; Infrared Spectra; Energy Budgets

47
METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20040086192 Washington Univ., Seattle, WA
International Arctic Buoy Programme Data Report, 1 January 2003 - 31 December 2003
Ortmeyer, Mark; Rigor, Ignatius; Jun. 2004; 206 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-98-1-0698
Report No.(s): AD-A424590; APL-UW-TM-2-04; No Copyright; Avail: CASI; A10, Hardcopy

This report presents data collected by the International Arctic Buoy Programme (IABP) between 1 January 2003 and 31 December 2003. The network of automatic data buoys deployed by the IABP monitors synoptic-scale fields of pressure, temperature, and ice motion throughout the Arctic Basin.
DTIC
Arctic Ocean; Arctic Regions; Buoys; Ice Reporting

20040086283 Army Research Lab., White Sands Missile Range, NM
A Mesoscale Modeling System Developed for the U.S. Army
Dumais, Robert E., Jr.; Henmi, Teizi; Passner, Jeffrey; Jameson, Terry; Haines, Pat; Apr. 2004; 50 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424766; ARL-TR-3183; No Copyright; Avail: CASI; A03, Hardcopy

The U.S. Army Battlescale Forecast Model (BFM) is a short-range forecasting tool designed to run on a workstation in a tactical environment. The model is hydrostatic and remains computationally stable at large time steps due to alternating-direction implicit finite differencing. The model assimilates data using Newtonian relaxation to incorporate observations and time-tendencies of forecast variables from a previously run numerical model. The U.S. Army uses the BFM to produce real-time, short-range mesoscale forecasts either as input to tactical weather decision aids or to produce more precise firing solutions in artillery. Using a timely and accurate four-dimensional gridded database of meteorological information, a battlefield commander can receive critical guidance that can assist in determining appropriate courses of action in a rapidly changing battlefield weather environment. Standard statistical measures and a few case studies demonstrate the model s merits.
DTIC
Atmospheric Models; Combat; Forecasting; Mesoscale Phenomena; Meteorological Parameters; Simulation

20040086557 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Real-Time Very High-Resolution Regional 4D Assimilation in Supporting CRYSTAL-FACE Experiment
Wang, Donghai; Minnis, Patrick; August 2004; 9 pp.; In English
Contract(s)/Grant(s): NAG5-11477; No Copyright; Avail: CASI; A02, Hardcopy

To better understand tropical cirrus cloud physical properties and formation processes with a view toward the successful modeling of the Earth's climate, the CRYSTAL-FACE (Cirrus Regional Study of Tropical Anvils and Cirrus Layers - Florida Area Cirrus Experiment) field experiment took place over southern Florida from 1 July to 29 July 2002. During the entire field campaign, a very high-resolution numerical weather prediction (NWP) and assimilation system was performed in support of the mission with supercomputing resources provided by NASA Center for Computational Sciences (NCCS). By using NOAA NCEP Eta forecast for boundary conditions and as a first guess for initial conditions assimilated with all available observations, two nested 15/3 km grids are employed over the CRYSTAL-FACE experiment area. The 15-km grid covers the southeast US domain, and is run two times daily for a 36-hour forecast starting at 0000 UTC and 1200 UTC. The nested 3-km grid covering only southern Florida is used for 9-hour and 18-hour forecasts starting at 1500 and 0600 UTC, respectively. The forecasting system provided more accurate and higher spatial and temporal resolution forecasts of 4-D atmospheric fields over the experiment area than available from standard weather forecast models. These forecasts were essential for flight planning during both the afternoon prior to a flight day and the morning of a flight day. The forecasts were used to help decide takeoff

times and the most optimal flight areas for accomplishing the mission objectives. See more detailed products on the web site http://asd-www.larc.nasa.gov/mode/crystal. The model/assimilation output gridded data are archived on the NASA Center for Computational Sciences (NCCS) UniTree system in the HDF format at 30-min intervals for real-time forecasts or 5-min intervals for the post-mission case studies. Particularly, the data set includes the 3-D cloud fields (cloud liquid water, rain water, cloud ice, snow and graupe/hail).
Derived from text
Cirrus Clouds; Florida; Tropical Regions; High Resolution; Real Time Operation; Cloud Physics; Anvil Clouds

20040086560 Washington Univ., Seattle, WA, USA
Lagrangian Assimilation of Satellite Data for Climate Studies in the Arctic
Lindsay, Ronald W.; Zhang, Jin-Lun; Stern, Harry; August 04, 2004; 7 pp.; In English
Contract(s)/Grant(s): NAG5-10621; No Copyright; Avail: CASI; A02, Hardcopy

Under this grant we have developed and tested a new Lagrangian model of sea ice. A Lagrangian model keeps track of material parcels as they drift in the model domain. Besides providing a natural framework for the assimilation of Lagrangian data, it has other advantages: 1) a model that follows material elements is well suited for a medium such as sea ice in which an element retains its identity for a long period of time; 2) model cells can be added or dropped as needed, allowing the spatial resolution to be increased in areas of high variability or dense observations; 3) ice from particular regions, such as the marginal seas, can be marked and traced for a long time; and 4) slip lines in the ice motion are accommodated more naturally because there is no internal grid. Our work makes use of these strengths of the Lagrangian formulation.
Derived from text
Arctic Regions; Climate; Lagrangian Function; Mathematical Models; Data Acquisition

20040086571 NASA Langley Research Center, Hampton, VA, USA
Regional Climatology and Surface Radiation Budget
Wilber, Anne C.; Smith, G. Louis; Stackhouse, Paul W., Jr.; [1999]; 4 pp.; In English
Contract(s)/Grant(s): NAS1-19579; NAG1-1959; Copyright; Avail: CASI; A01, Hardcopy

The climatology and surface radiation budget (SRB) of a region are intimately related. This paper presents a brief examination of this relationship. An 8-year surface radiation budget data set has been developed based on satellite measurements. In that data set and in this paper a region is defined as a quasi-square 2.5o in latitude and approximately the same physical distance in longitude. A pilot study by Wilber et al. (1998) showed a variety of behaviors of the annual cycles for selected regions. Selected desert regions form a loop in a specific part of the plot, with large NLW and large NSW. Tropical wet regions form much smaller loops in a different part of the plot, with small NLW and large NSW. For regions selected in high latitude the annual cycles form nearly linear figures in another part of the plot. The question arises as to whether these trajectories are characteristic of the climatology of the region or simply the behavior of the few regions selected from the set of 6596 regions. In order to address this question, it is necessary to classify the climatology of the each region, e.g. as classified by Koeppen (1936) or Trenwarthe and Horne (1980). This paper presents a method of classifying climate of the regions on the basis of the surface radiation behavior such that the results are very similar to the classification of Trenwarthe and Horne. The characteristics of the annual cycle of SRB components can then be investigated further, based on the climate classification of each region.
Derived from text
Atmospheric Radiation; Climatology; Energy Budgets

20040086580 NASA Langley Research Center, Hampton, VA, USA
A Comparison Of Cloud Microphysical Properties Derived Using VIRS 3.7 Micron and 1.6 Micron Data
Young, David F.; Minnis, Patrick; Arduini, Robert F.; [1999]; 4 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

One of the main objectives of the Clouds and the Earth's Radiant Energy System (CERES) project is the retrieval of cloud physical and microphysical properties simultaneously with observations of broadband radiative fluxes. These cloud parameter sare used for three main purposes: 1) to provide data for radiation-cloud climate feedback studies; 2) to provide scene identification data for the construction and application of angular distribution models; and 3) to be used as input to radiative transfer calculations of intra-atmospheric fluxes
Derived from text
Cloud Physics; Radiative Transfer; Feedback

20040086628 NASA Langley Research Center, Hampton, VA, USA

What is Success? Evaluating S'COOL, an Educational Outreach Project Focused on NASA's CERES Program

Chambers, Lin H.; Costulis, P. Kay; Young, David F.; Green, Carolyn J.; Stoddard, Douglas B.; Haberer, Susan J.; [2000]; 23 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

The Students' Cloud Observations On-Line (S'COOL) Project involved students in K-16 as ground truth observers for a NASA Earth-Observing satellite instrument. The Clouds and Earth's Radiant Energy System (CERES) instrument allows scientists to study the Earth's energy budget and how clouds affect it. Student reports of cloud conditions help scientists verify their algorithms and allow students to be involved in obtaining and analyzing real scientific data. The presentation contains 23 slides.

Derived from text

Clouds (Meteorology); Ground Truth; Satellite Instruments; Students; Visual Observation

20040086649 Case Western Reserve Univ., Cleveland, OH, USA

Long Term Monitoring of Seasonal and Weather Stations and Analysis of Data from SHRP Pavements

Figeroa, J. L.; Mar. 2004; In English

Report No.(s): PB2004-105827; No Copyright; Avail: National Technical Information Service (NTIS)

External agents such as traffic and climate directly affect the life of flexible and rigid pavements. To understand the influence of these factors, a test road located on U.S. 23, just North of Delaware in Ohio, was constructed as part of the Federal Highway Administration's SHRP Program. Material properties and the effect of environmental factors on pavements were studied. Knowing the dynamic response of pavement materials and environmental factors to which they are exposed, back calculation procedures to estimate the resilient modulus and the modulus of subgrade reaction of the subgrade soil from non-destructive testing deflections were developed using ILLIPAVE and ILLISLAB for flexible and rigid pavements, respectively. Relationships between the resilient modulus at the break point and the degree of saturation were developed for the subgrade soil, while relationships between resilient modulus and temperature were developed for asphaltic materials. All test data, including moisture content, pavement and soil temperature and resistivity, as well as weather-related parameters collected at all instrumented sections at the test road were processed.

NTIS

Moisture Content; Climate; Soils; Management

20040086663 Savannah River Ecology Lab., Aiken, SC, USA

Wind Climate Analyses for SRTC's Central Climatology Site

Weber, A. H.; Buckley, R. L.; Kurzeja, R. J.; Apr. 2003; In English

Report No.(s): DE2004-812064; WSRC-TR-2003-00141; No Copyright; Avail: National Technical Information Service (NTIS)

This report was written to present climatological summaries of the wind data at the Central Climatology (CC) tower in a convenient format and to point out some features of the wind speed and direction that have not been widely appreciated in the past. Short-term (two-week) wind roses provide a means to demonstrate the temporal and spatial relationships that wind speed and direction undergo using a ten-year database from the CC tower. These relationships are best demonstrated by examining the figures provided in this report or looking at loops of computer-generated images provided by the authors.

NTIS

Climatology; Wind Measurement; Wind Direction

20040086673 NASA Langley Research Center, Hampton, VA, USA

Far Infrared Measurements of Cirrus

Nolt, I. G.; Vanek, M. D.; Tappan, N. D.; Minnis, P.; Alltop, J. L.; Ade, A. R.; Lee, C.; Hamilton, P. A.; Evans, K. F.; Evans, A. H., et al.; [1999]; 11 pp.; In English; Remote Sensing of Clouds and Atmosphere, 20-23 Sep. 1999, Florence, Italy; Copyright; Avail: CASI; A03, Hardcopy

Improved techniques for remote sensing of cirrus are needed to obtain global data for assessing the effect of cirrus in climate change models. Model calculations show that the far infrared/sub-millimeter spectral region is well suited for retrieving cirrus Ice Water Path and particle size parameters. Especially useful cirrus information is obtained at frequencies below 60 cm-1 where single particle scattering dominates over thermal emission for ice particles larger than about 50 m. Earth radiance spectra have been obtained for a range of cloud conditions using an aircraft-based Fourier transform spectrometer. The Far InfraRed Sensor for Cirrus (FIRSC) is a Martin-Puplett interferometer which incorporates a polarizer for the

beamsplitter and can be operated in either intensity or linear polarization measurement mode. Two detector channels span 10 to 140 cm-1 with a spectral resolution of 0.1 cm-1; achieving a Noise Equivalent Temperature of approximately 1K at 30 cm-1 in a 4 sec scan. Examples are shown of measured and modeled Earth radiance for a range of cloud conditions from 1998 and 1999 flights.
Author
Far Infrared Radiation; Remote Sensing; Cirrus Clouds; Atmospheric Models; Ice; Polarizers; Interferometers

20040086737 NASA Langley Research Center, Hampton, VA, USA
Self Validation of Radiance Measurements from the CERES (TRMM)Instrument
Paden, Jack; Pandey, Dhirendra K.; Lee, Robert B., III; Priestley, Kory J.; [1999]; 10 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

Eight continuous months of earth-nadir-viewing radiance measurements from the 3-channel Tropical Rainfall Measuring Mission (TRMM,) Clouds and the Earth's Radiant Energy System (CERES) scanning radiometric measurement instrument, have been analyzed. While previous remote sensing satellites, such as the Earth Radiation Budget Experiment (ERBE) covered all subsets of the broadband radiance spectrum (total, longwave and shortwave.) CERES has two subset channels (window and shortwave) which do not give continuous frequency coverage over the total band. Previous experience with ERBE indicated the need for us to model the equivalent daytime longwave radiance using a window channel regression, which will allow us to validate the performance of the instrument using a three-channel inter-comparison. Limiting our consideration to the fixed azimuth plane, cross-track, scanning mode (FAPS), each nadir-viewing measurement was averaged into three subjective categories called daytime, nighttime, and twilight. Daytime was defined as any measurement taken when the solar zenith angle (SZA) was less than 90 ; nighttime was taken to be any measurement where the SZA was greater than 117 ; and twilight was everything else. Our analysis indicates that there are only two distinct categories of nadir-view data; daytime, and non-daytime (i.e., the union of the nighttime and twilight sets); and that the CERES longwave radiance is predictable to an accuracy of 1%, based on the SZA, and window channel measurements.
Author
Earth Radiation Budget Experiment; Radiant Flux Density; Trmm Satellite; Remote Sensing; Earth Radiation Budget

20040086764 NASA Langley Research Center, Hampton, VA, USA
CERES: The Next Generation of Earth Radiation Budget Measurements
Gibson, Gary G.; Wielicki, Bruce A.; [1999]; 6 pp.; In English; Conference on Remote Sensing of Clouds and the Atmosphere, 20-24 Sep. 1999, Florence, Italy; No Copyright; Avail: CASI; A02, Hardcopy

NASA's Earth Observing System (EOS) is part of an international program for studying the Earth from space using a multiple-instrument, multiple-satellite approach. The Clouds and the Earth's Radiant Energy System (CERES) experiment is designed to monitor changes in the Earth s radiant energy system and cloud systems and to provide these data with sufficient simultaneity and accuracy to examine critical cloud/climate feedback mechanisms which may play a major role in determining future changes in the climate system. The first EOS satellite (Terra), scheduled for launch this year, and the EOS-PM satellite, to be launched in late 2000, will each carry two CERES instruments. The first CERES instrument was launched in 1997 on the Tropical Rainfall Measuring Mission (TRMM) satellite. The CERES TRMM data show excellent instrument stability and a factor of 2 to 3 less error than previous Earth radiation budget missions. The first CERES data products have been validated and archived. The data consist of instantaneous longwave and shortwave broadband radiances, top-of-atmosphere fluxes, scene types, and time and space averaged fluxes and albedo. A later data product will combine CERES radiances and high-resolution imager data to produce cloud properties and fluxes throughout the atmosphere and at the surface.
Author
Earth Radiation Budget; Earth Observing System (EOS); Earth Observations (From Space); Climate Change; Cloud Physics

20040086776 North Carolina State Univ., Raleigh, NC, USA
A New Eddy Dissipation Rate Formulation for the Terminal Area PBL Prediction System(TAPPS)
Charney, Joseph J.; Kaplan, Michael L.; Lin, Yuh-Lang; Pfeiffer, Karl D.; [2000]; 19 pp.; In English; 38th Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2000, Reno, NV, USA
Contract(s)/Grant(s): NAS1-99097
Report No.(s): AIAA-Paper 2000-0624; Copyright; Avail: CASI; A03, Hardcopy

The TAPPS employs the MASS model to produce mesoscale atmospheric simulations in support of the Wake Vortex project at Dallas Fort-Worth International Airport (DFW). A post-processing scheme uses the simulated three-dimensional

atmospheric characteristics in the planetary boundary layer (PBL) to calculate the turbulence quantities most important to the dissipation of vortices: turbulent kinetic energy and eddy dissipation rate. TAPPS will ultimately be employed to enhance terminal area productivity by providing weather forecasts for the Aircraft Vortex Spacing System (AVOSS). The post-processing scheme utilizes experimental data and similarity theory to determine the turbulence quantities from the simulated horizontal wind field and stability characteristics of the atmosphere. Characteristic PBL quantities important to these calculations are determined based on formulations from the Blackadar PBL parameterization, which is regularly employed in the MASS model to account for PBL processes in mesoscale simulations. The TAPPS forecasts are verified against high-resolution observations of the horizontal winds at DFW. Statistical assessments of the error in the wind forecasts suggest that TAPPS captures the essential features of the horizontal winds with considerable skill. Additionally, the turbulence quantities produced by the post-processor are shown to compare favorably with corresponding tower observations.
Author
Wind Velocity; Planetary Boundary Layer; Weather Forecasting; Turbulence

20040086825 NASA Goddard Space Flight Center, Greenbelt, MD, USA, Harvard Univ., Cambridge, MA, USA, NASA Ames Research Center, Moffett Field, CA, USA
Methods for Validation and Intercomparison of Remote Sensing and In situ Ice Water Measurements: Case Studies from CRYSTAL-FACE and Model Results
Sayres, D.S.; Pittman, J. V.; Smith, J. B.; Weinstock, E. M.; Anderson, J. G.; Heymsfield, G.; Li, L.; Fridlind, A.; Ackerman, A. S.; [2004]; 5 pp.; In English
Contract(s)/Grant(s): NAG5-15487; No Copyright; Avail: CASI; A01, Hardcopy

Remote sensing observations, such as those from AURA, are necessary to understand the role of cirrus in determining the radiative and humidity budgets of the upper troposphere. Using these measurements quantitatively requires comparisons with in situ measurements that have previously been validated. However, a direct comparison of remote and in situ measurements is difficult due to the requirement that the spatial and temporal overlap be sufficient in order to guarantee that both instruments are measuring the same air parcel. A difficult as this might be for gas phase intercomparisons, cloud inhomogeneities significantly exacerbate the problem for cloud ice water content measurements. The CRYSTAL-FACE mission provided an opportunity to assess how well such intercomparisons can be performed and to establish flight plans that will be necessary for validation of future satellite instruments. During CRYSTAL-FACE, remote and in situ instruments were placed on different aircraft (NASA's ER-2 and WB-59, and the two planes flew in tandem so that the in situ payload flew in the field of view of the remote instruments. We show here that, even with this type of careful flight planning, it is not always possible to guarantee that remote and in situ instruments are viewing the same air parcel. We use ice water data derived from the in situ Harvard Total Water (HV-TW) instrument, and the remote Goddard Cloud Radar System (CRS) and show that agreement between HV-TW and CRS is a strong function of the horizontal separation and the time delay between the aircraft transects. We also use a cloud model to simulate possible trajectories through a cloud and evaluate the use of statistical analysis in determining the agreement between the two instruments. This type of analysis should guide flight planning for future intercomparison efforts, whether for aircraft or satellite-borne instrumentation.
Author
Remote Sensing; Troposphere; Moisture Content; Humidity; Atmospheric Models; Clouds (Meteorology)

20040086878 Harvard Univ., Cambridge, MA, USA
Measurements of the Ice Water Content of Cirrus in the Tropics and Subtropics, I, Instrument Details and Validation
Weinstock, E. M.; Smith, J. B.; Sayres, D.; Pittman, J. V.; Allen, N.; Demusz, J.; Greenberg, M.; Rivero, M.; Anderson, J. G.; [12003]; 28 pp.; In English
Contract(s)/Grant(s): NAG5-115487; No Copyright; Avail: CASI; A03, Hardcopy

We describe an instrument mounted in a pallet on the NASA WB-57 aircraft that is designed to measure the sum of gas phase and solid phase water, or total water, in cirrus clouds. Using an isokinetic inlet, a 600-watt heater mounted directly in the flow, and Lyman-alpha photofragment fluorescence technique for detection, accurate measurements of total water have been made over almost three orders of magnitude. Isokinetic flow is achieved with an actively controlled roots pump by referencing aircraft pressure, temperature, and true air speed, together with instrument flow velocity, temperature, and pressure. During CRYSTAL FACE, the instrument operated at duct temperatures sufficiently warm to completely evaporate particles up to 150 microns diameter. In flight diagnostics, intercomparison with water measured by absorption in flight, as well as intercomparisons in clear air with water vapor measured by the Harvard water vapor instrument and the JPL infrared tunable diode laser hygrometer validate the detection sensitivity of the instrument and illustrate minimal hysteresis from

instrument surfaces. The simultaneous measurement of total water and water vapor in cirrus clouds yields their ice water content.
Author
Cirrus Clouds; Lyman Alpha Radiation; Water Vapor; Ice; Vapor Phases; Solid Phases; Moisture Content

20040086881 NASA Langley Research Center, Hampton, VA, USA
SHDOM
Evans, K. Franklin; Chambers, Lin H.; [2000]; 5 pp.; In English; Copyright; Avail: CASI; A01, Hardcopy

SHDOM is a general purpose, publicly available, three-dimensional atmospheric radiative transfer model. SHDOM is an explicit method, which means it solves for the whole radiation field, as distinct from Monte Carlo methods which solve for particular radiative outputs. SHDOM is particularly well suited for remote sensing applications, where it can compute outgoing radiances at many angles from a cloud field at virtually no extra cost. SHDOM is not appropriate for calculating domain average quantities for which Monte Carlo methods excel. The I3RC intercomparison offers an opportunity to explore the pros and cons of SHDOM and Monte Carlo models on some real world inhomogeneous cloud fields. Specifically, we wish to determine the computer resources required to achieve a particular accuracy for a certain number of outputs using SHDOM and Monte Carlo models. This will help guide modelers on the appropriate choice of SHDOM or Monte Carlo for their applications. To emphasize the importance of this accuracy versus CPU time tradeoff, we are submitting two SHDOM entries (low and high resolution) in the I3RC.
Author
Radiance; Atmospheric Models; Three Dimensional Models; Monte Carlo Method; Remote Sensing

20040086886 Meteorological Satellite Center, Kiyose, Japan
Monthly Report of the Meteorological Satellite Center: May 2004
May 2004; 1 pp.; In English; In Japanese; Document files and Satellite observation data are recorded in either ASCII or shift JIS code; Full Disk Earth's Cloud Images are recored in Bit-Map (BMP) format; Copyright; Avail: Other Sources

The CD-ROM concerning the Monthly Report of the Meteorological Satellite Center (MSC) Contains the observation data derived from the Geostationary Meteorological Satellite (GMS) of Japan and the polar orbital meteorological satellites operated by NOAA. The CD-ROM contains following observation data. FuII Disk Earth's Cloud, Cloud Image of Japan and its Vicinity, Cloud Amount, Sea Surface Temperature, Cloud Motion Wind, Water Vapor Motion Wind, Equivalent Blackbody Temperature, OLR (Outgoing Longwave Radiation), Solar Irradiation, Snow and Ice Index, Orbit Data, Attitude Data, VISSR Image Data Catalog, (Cartridge Magnetic Tape (CMT), Micro Film), TOVS (TIROS Operational Vertical Sounder) Vertical Profile of Temperature and Precipitable Water, TOVS Total Ozone Amount. Although this user' s guide is revised yearly, it may happen that a change of contents of the Monthly Report is not reflected in the user's guide, if the change is carried out between revisions of the user's guide. The latest contents of the Monthly Report and the detailed information of the contents are described in document files which are contained in the CD-ROM,t.
Author
Atmospheric Sounding; Japan; Satellite Observation; Satellite Sounding; Meteorological Parameters; Satellite Imagery

20040086906 NASA Ames Research Center, Moffett Field, CA, USA
PSC Characteristics from Satellite Observations and Simulations
Strawa, A. W.; Drdla, K.; Bokarius, K.; Fromm, M.; Alfred, J.; [2004]; 1 pp.; In English; Solar Oculation Satellite Science Team Meeting, 14-17 Jun. 2004, USA; No Copyright; Avail: Other Sources; Abstract Only

POAM solar occultation observations from 1994 to present are studied for the purpose of determining Type I PSC formation characteristics and winter-long evolution. This study examines PSC observations from many years on a common basis to see if characteristics can be identified. The results show that Type Ia PSCs form at the beginning of the winter, within several days of the first drop in temperature below T_NAT, and peak early in the winter. Type Ia PSCs typically out number Ib PSCs over the winter, especially at the beginning of the winter. Type Ia and Ib PSC observations continue throughout the winter. Micro-physical models of PSC formation must match these observed characteristics. Some models predict that temperatures must be more than 5 K below T_NAT for five days before significant freezing can occur. This is not seen in the POAM observations. Differences in PSC characteristics between the first two Arctic winters (1994-1995 and 1995-1996) and later winters also suggest the influence of volcanic perturbations on PSC formation. Type Ia and Ib PSC Characteristics

observed by POAM III and SAGE III for the 2002-2003 Arctic winter are compared.
Author
Satellite Observation; Computerized Simulation; Stratosphere; Clouds (Meteorology); Polar Regions

20040086915 NASA Ames Research Center, Moffett Field, CA, USA
Microphysics of Pyrocumulonimbus Clouds
Jensen, Eric; Ackerman, Andrew S.; Fridlind, Ann; [2004]; 3 pp.; In English; 14th International Conference on Clouds and Precipitation; No Copyright; Avail: CASI; A01, Hardcopy

The intense heat from forest fires can generate explosive deep convective cloud systems that inject pollutants to high altitudes. Both satellite and high-altitude aircraft measurements have documented cases in which these pyrocumulonimbus clouds inject large amounts of smoke well into the stratosphere (Fromm and Servranckx 2003; Jost et al. 2004). This smoke can remain in the stratosphere, be transported large distances, and affect lower stratospheric chemistry. In addition recent in situ measurements in pyrocumulus updrafts have shown that the high concentrations of smoke particles have significant impacts on cloud microphysical properties. Very high droplet number densities result in delayed precipitation and may enhance lightning (Andrew et al. 2004). Presumably, the smoke particles will also lead to changes in the properties of anvil cirrus produces by the deep convection, with resulting influences on cloud radiative forcing. In situ sampling near the tops of mature pyrocumulonimbus is difficult due to the high altitude and violence of the storms. In this study, we use large eddy simulations (LES) with size-resolved microphysics to elucidate physical processes in pyrocumulonimbus clouds.
Derived from text
Cumulonimbus Clouds; Cloud Physics; Atmospheric Models; Clouds (Meteorology)

20040087107 NASA Ames Research Center, Moffett Field, CA, USA
Dehydration in the Winter Arctic Tropopause Region
Pfister, Leonhard; Jensen, Eric; Podolske, James; Selkirk, Henry; Anderson, Bruce; Avery, Melody; Diskin. Glenn; [2004]; 1 pp.; In English; Stratospheric Processes and their Role in Climate (SPARC) Conference, 12-6 Aug. 2004, Victoria, British Columbia, Canada; No Copyright; Avail: Other Sources; Abstract Only

Recent work has shown that limited amounts of tropospheric air can penetrate as much as 1 km into the middleworld stratosphere during the arctic winter. This, coupled with temperatures that are cold enough to produce saturation mixing ratios of less than 5 ppmv at the tropopause, results in stratospheric cloud formation and upper tropospheric dehydration. Even though these ‘cold outbreaks’ occupy only a small portion of the area in the arctic (1-2%), their importance is magnified by an order of magnitude because of the air flow through them. This is reinforced by evidence of progressive drying through the winter measured during SOLVE-1. The significance of this process lies in its effect on the upper tropospheric water content of the middle and high latitude tropopause region, which plays an important role in regulating the earth’s radiative balance. There appears to be significant year-to-year variability in the incidence of the cold outbreaks. This work has two parts. First, we describe case studies of dehydration taken from the SOLVE and SOLVE2 aircraft sampling missions during the Arctic winters of 2000 and 2003 respectively. Trajectory based microphysical modeling is employed to examine the sensitivity of the dehydration to microphysical parameters and the nature of sub-grid scale temperature fluctuations. We then examine the year-to-year variations in potential dehydration using a trajectory climatology.
Author
Arctic Regions; Climatology; Dehydration; Tropopause; Winter

20040087128 NASA Ames Research Center, Moffett Field, CA, USA
Implications of Enhanced Relative Humidity in Cold Tropical Cirrus
Jensen, Eric; Pfister, Leonhard; [2004]; 1 pp.; In English; Stratospheric Processes and Their Role in Climate (SPARC) 3rd General Assembly, 1-6 Aug. 2004, Victoria, British Columbia, Canada; No Copyright; Avail: Other Sources; Abstract Only

In situ measurements of water vapor concentration and temperature in tropical cirrus during the CRYSTAL-FACE and Pre-AVE missions indicate that the steady-state relative humidity within cirrus at T less than 200 K is about 20-30% higher than ice saturation. These measurements challenge the conventional belief, that any water vapor in excess of ice saturation should be depleted by crystal growth given sufficient time. Detailed simulations of thin cirrus near the tropopause indicate that this enhanced steady-state relative humidity increases ice number densities, decreases crystal sizes and extends cloud lifetimes. The areal coverage of thin cirrus in the tropics is increased rather than decreased as indicated by simpler conceptual models. Perhaps most significantly, the increased steady-state H2O saturation mixing ratio over ice in thin cirrus near the tropopause results in about a 0.5-1 ppmv increase in the amount of water that can enter the stratosphere across the tropical tropopause

cold trap. Hence, the enhanced steady-state relative humidity in cold cirrus implies that lower tropopause temperatures are required to explain the observed stratospheric water vapor mixing ratios than previously assumed.
Author
Humidity; Tropical Regions; Cirrus Clouds; Cold Traps

20040087186 NASA Langley Research Center, Hampton, VA, USA
A Real-Time Satellite-Based Icing Detection System
Minnis, Patrick; Smith, William L., Jr.; Nguyen, Louis; Khaiyer, Mandana M.; Spangenberg, Douglas A.; Heck, Patrick W.; Palikonda, Rabindra; Bernstein, Ben C.; McDonough, Frank; July 18, 2004; 5 pp.; In English; 14th International Conference on Clouds and Precipitation (ICCP 2004), 18-23 Jul. 2004, Bologna, Italy
Contract(s)/Grant(s): DE-A102-97ER-62341; 728-40-10; Copyright; Avail: CASI; A01, Hardcopy

Aircraft icing is one of the most dangerous weather conditions for general aviation. Currently, model forecasts and pilot reports (PIREPS) constitute much of the database available to pilots for assessing the icing conditions in a particular area. Such data are often uncertain or sparsely available. Improvements in the temporal and areal coverage of icing diagnoses and prognoses would mark a substantial enhancement of aircraft safety in regions susceptible to heavy supercooled liquid water clouds. The use of 3.9 microns data from meteorological satellite imagers for diagnosing icing conditions has long been recognized (e.g., Ellrod and Nelson, 1996) but to date, no explicit physically based methods have been implemented. Recent advances in cloud detection and cloud property retrievals using operational satellite imagery open the door for real-time objective applications of those satellite datasets for a variety of weather phenomena. Because aircraft icing is related to cloud macro- and microphysical properties (e.g., Cober et al. 1995), it is logical that the cloud properties from satellite data would be useful for diagnosing icing conditions. This paper describes the a prototype realtime system for detecting aircraft icing from space.
Author
Aircraft Icing; Detection; Real Time Operation; Satellite Imagery; Meteorological Satellites; Weather; Clouds (Meteorology)

20040087187 NASA Langley Research Center, Hampton, VA, USA
An Examination of the Impact of Drizzle Drops on Satellite-Retrieved Effective Particle Sizes
Minnis, Patrick; Arduini, Robert F.; Young, David F.; Ayers, J, Kirk; Albrecht, Bruce A.; Sharon, Tarah; Stevens, Bjorn; July 8, 2004; 5 pp.; In English; 14th International Conference on Clouds and Precipitation (ICCP 2004), 18-23 Jul. 2004, Bologna, Italy
Contract(s)/Grant(s): NA00AANRG0330; 621-30-96; Copyright; Avail: CASI; A01, Hardcopy

In general, cloud effective droplet radii are remotely sensed in the near-infrared using the assumption of a monomodal droplet size distribution. It has been observed in many instances, especially in relatively pristine marine environments, that cloud effective droplet radii derived from satellite data often exceed 15 m or more. Comparisons of remotely sensed and in situ retrievals indicate that the former often overestimates the latter in clouds with drizzle-size droplets. To gain a better understanding of this discrepancy, this paper performs a theoretical and empirical evaluation of the impact of drizzle drops on the derived effective radius.
Author
Drop Size; Size Distribution; Drops (Liquids)

20040087311 National Center for Atmospheric Research, Boulder, CO
Diurnal to Decadal Global Forcing for ocean and Sea-Ide Models: The Data Sets and Flux Climatologies
Large, W. G.; Yeager, S. G.; May 2004; In English
Report No.(s): PB2004-105835; NCAR/TN-460-STR; No Copyright; Avail: National Technical Information Service (NTIS)

All aspects of the bulk forcing methodology are developed for two model configurations; a stand-alone Ocean General Circulation Model (OGCM) and an OGCM coupled to a Sea-Ice Model (SIM). The air-sea and, for the latter, air-ice surface boundary conditions are computed from the prognostic model surface temperatures, combined with the specified near surface atmospheric state, downwelling radiation, precipitation and continental runoff. In the former, observed sea-ice concentration and specified ice-ocean fluxes effectively replace the SIM, and eliminate the need for air-ice fluxes. In both cases, some restoring to observed sea surface temperature and/or salinity is possible.
NTIS
Ocean Models; Climatology

20040087313 National Center for Atmospheric Research, Boulder, CO
Technical Description of the Community Land Model (CLM)
Oleson, K. W.; Dai, Y.; Bosilovich, M.; Dickinson, R.; Dirmeyer, P.; May 2004; 190 pp.; In English
Report No.(s): PB2004-105836; NCAR/TN-461-STR; No Copyright; Avail: CASI; A09, Hardcopy

This technical note describes the physical parameterizations and numerical implementation of version 3.0 of the Community Land Model (CLM3.0) which is the land surface parameterization used with the Community Atmosphere Model (CAM3.0) and the Community Climate System Model (CCSM3.0). Chapters 1-11 constitute the description of CLM when coupled to CAM or CCSM, while Chapter 12 describes processes that pertain specifically to the operation of CLM in offline mode (uncoupled to an atmospheric model). This technical note, the CLM3.0 Developer's Guide, and the CLM3.0 User's Guide together provide the user with the scientific description, coding implementation, and operating instructions for CLM. The CLM Dynamic Global Vegetation Model (CLM-DGVM) is described in Levis et al.
NTIS
Atmospheric Models; Earth Surface

20040090472 NASA Langley Research Center, Hampton, VA, USA
Evidence for Natural Variability in Marine Stratocumulus Cloud Properties Due to Cloud-Aerosol
Albrecht, Bruce; Sharon, Tarah; Jonsson, Haf; Minnis, Patrick; Minnis, Patrick; Ayers, J. Kirk; Khaiyer, Mandana M.; July 9, 2004; 5 pp.; In English; 14th International Conference on Clouds and Precipitation (ICCP 2004), 18-23 Jul. 2004, Bologna, Italy
Contract(s)/Grant(s): NSF ATM-99-02416; NA00AABRG03330; 728-40-10; Copyright; Avail: CASI; A01, Hardcopy

In this study, aircraft observations from the Interdisciplinary Remotely-Piloted Aircraft Studies (CIRPAS) Twin Otter are used to characterize the variability in drizzle, cloud, and aerosol properties associated with cloud rifts and the surrounding solid clouds observed off the coast of California. A flight made on 16 July 1999 provided measurements directly across an interface between solid and rift cloud conditions. Aircraft instrumentation allowed for measurements of aerosol, cloud droplet, and drizzle spectra. CCN concentrations were measured in addition to standard thermodynamic variables and the winds. A Forward Scatter Spectrometer Probe (FSSP) measured size distribution of cloud-sized droplets. A Cloud Imaging Probe (CIP) was used to measure distributions of drizzle-sized droplets. Aerosol distributions were obtained from a Cloud Aerosol Scatterprobe (CAS). The CAS probe measured aerosols, cloud droplets and drizzle-sized drops; for this study. The CAS probe was used to measure aerosols in the size range of 0.5 micron - 1 micron. Smaller aerosols were characterized using an Ultrafine Condensation Particle Counter (CPC) sensor. The CPC was used to measure particles with diameters greater than 0.003 micron. By subtracting different count concentrations measured with the CPC, this probe was capable of identifying ultrafine particles those falling in the size range of 3 nanometers - 7 nanometers that are believed to be associated with new particle production.
Derived from text
Stratocumulus Clouds; Marine Meteorology; Aerosols

20040090612 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Cloud Detection and UV Monitoring Experiment (CLUE)
Barbier, L.; Loh, E.; Sokolsky, P.; Streitmatter, R.; [2004]; 1 pp.; In English; COSPAR, 18-25 Jul. 2004, Paris, France; Copyright; Avail: Other Sources; Abstract Only

We propose a large-area, low-power instrument to perform CLoud detection and Ultraviolet monitoring, CLUE. CLUE will combine the W detection capabilities of the NIGHTGLOW payload, with an array of infrared sensors to perform cloud slicing measurements. Missions such as EUSO and OWL which seek to measure UHE cosmic-rays at 1W20 eV use the atmosphere as a fluorescence detector. CLUE will provide several important correlated measurements for these missions, including: monitoring the atmospheric W emissions &om 330 - 400 nm, determining the ambient cloud cover during those W measurements (with active LIDAR), measuring the optical depth of the clouds (with an array of narrow band-pass IR sensors), and correlating LIDAR and IR cloud cover measurements. This talk will describe the instrument as we envision it.
Derived from text
Payloads; Infrared Detectors; Cloud Cover; Optical Radar; Cosmic Rays

20040090630 California Univ., Los Angeles, CA, USA
Sensitivity of Precipitation in Coupled Land-Atmosphere Models
Neelin, David; Zeng, N.; Suarez, M.; Koster, R.; [2004]; 4 pp.; In English
Contract(s)/Grant(s): NAG5-9358; No Copyright; Avail: CASI; A01, Hardcopy

The project objective was to understand mechanisms by which atmosphere-land-ocean processes impact precipitation in the mean climate and interannual variations, focusing on tropical and subtropical regions. A combination of modeling tools was used: an intermediate complexity land-atmosphere model developed at UCLA known as the QTCM and the NASA Seasonal-to-Interannual Prediction Program general circulation model (NSIPP GCM). The intermediate complexity model was used to develop hypotheses regarding the physical mechanisms and theory for the interplay of large-scale dynamics, convective heating, cloud radiative effects and land surface feedbacks. The theoretical developments were to be confronted with diagnostics from the more complex GCM to validate or modify the theory.
Author
Air Land Interactions; Precipitation (Meteorology); Atmospheric General Circulation Models

20040090631 National Center for Atmospheric Research, Boulder, CO, USA
Quality Control and Analysis of Microphysical Data Collected in TRMM Aircraft Validation Experiments
Heymsfield, Andrew J.; August 31, 2004; 6 pp.; In English
Contract(s)/Grant(s): NAG5-9663; No Copyright; Avail: CASI; A02, Hardcopy

This report summarizes our efforts on the funded project 'Quality Control and Analysis of Microphysical Data Collected in TRMM Airborne Validation Experiments', NASA NAG5-9663, Andrew Heymsfield, P. I. We begin this report by summarizing our activities in FY2000-FY2004. We then present some highlights of our work. The last part of the report lists the publications that have resulted from our funding through this grant.
Author
Trmm Satellite; Airborne Equipment; Quality Control

20040095304 Houston Univ., TX, USA
Making Antarctic Atmospheric Electricity Data Available to Living with a Star and Climate Change Investigators
Bering, Edgar; [2004]; 2 pp.; In English
Contract(s)/Grant(s): NAG5-13392; No Copyright; Avail: CASI; A01, Hardcopy

This proposal requests support for making the nearly three decades of Antarctic atmospheric electricity data available to more workers. Measurements of the vertical electric field and air-earth current density made at the Earth's surface in Antarctica have recently been shown to be of considerable interest to scientists interested in monitoring short-term Sun-Earth connections and long term climate change. Such measurements have been made off and on for more than three decades, primarily at Vostok and South Pole stations. There is no single place where all of these data can be obtained via the Internet in a contemporary format. The work proposed here will attempt to remedy this deficiency as much as possible. Data we know to be presently available include data from South Pole, 1982-86 and 1991-1993, and Vostok station, 1997-present. Data were taken at South Pole and Vostok in the 60's and ~O'S, but these may prove difficult to obtain in digital form. At present, only the University of Houston's 1991-1993 data are available on the Web. Unfortunately, they are stored on a server slated for retirement. Also, they are written VAX binary floating point, using the UCLA/Stanford/Michigan flatfile format (FLATDBMS), which is obscure to some users. We propose to combine and reformat the three available data sets plus any others we can obtain onto a newer server. We will use a more common and comprehensible format. Archival copies will be burned onto CD and/or DVD-ROM media. Finally we will register these data with the appropriate NASA data systems.
Author
Antarctic Regions; Atmospheric Electricity; Climate Change; Data Systems

20040095308 NASA Goddard Space Flight Center, Greenbelt, MD, USA
QBO Generated Inter-annual Variations of the Diurnal Tide in the Mesosphere
Mayr, Hans G.; Mengel, John G.; [2004]; 20 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

We report results from a study with the Numerical Spectral Model (NSM), which produces in the mesosphere significant inter-annual variations in the diurnal tide. Applying Hines Doppler Spread Parameterization (DPS), small-scale gravity waves (GW) drive the Quasi-biennial Oscillation (QBO) and Semi-annual Oscillation (SAO). With a GW source that peaks at the equator and is taken to be isotropic and independent of season, the NSM generates near the equator a QBO with variable periods around 27 months and zonal wind amplitudes close to 20 m / s at 30 Ism. As reported earlier, the NSM reproduces the observed equinoctial maxima in the diurnal tide at altitudes around 95 km. In the present paper it is shown that the QBO modulates the tide such that the seasonal amplitude maxima can vary from one year to another by as much as 30%. Since the period of the QBO is variable, its phase relative to the seasonal cycle changes. The magnitude of the QBO modulation of the tide thus varies considerably as our long-term model simulation shows. To shed light on the underlying mechanism, the

relative importance of the linearized advection terms are discussed that involve the meridional and vertical winds of the diurnal tide.
Author
Annual Variations; Diurnal Variations; Mathematical Models; Mesosphere; Quasi-Biennial Oscillation

20040095316 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Small-Scale Variability of Large Cloud Drops
Marshak, Alexander; Knyazikhin, Y.; Wiscombe, Warren; January 2004; 1 pp.; In English; IUGG Conference on Mathematical Geophysics, 16-18 Jun. 2004, New York, NY, USA; No Copyright; Avail: Other Sources; Abstract Only

Cloud droplet size distribution is one of the most fundamental subjects in cloud physics. Understanding of spatial distribution and small-scale fluctuations of cloud droplets is essential for both cloud physics and atmospheric radiation. For cloud physics, it relates to the coalescence growth of raindrops while for radiation, it has a strong impact on a cloud's radiative properties. Most of the existing cloud radiation and precipitation formation models assume that the mean number of drops with a given radius varies proportionally to volume. The analysis of microphysical data on liquid water drop sizes shows that, for sufficiently small volumes, the number is proportional to the drop size dependent power of the volume. For abundant small drops present, the exponent is 1 as assumed in the conventional approach. However, for rarer large drops, the exponents fall below unity. At small scales, therefore, the mean number of large drops decreases with volume at a slower rate than the conventional approach assumes, suggesting more large drops at these scales than conventional models account for; their impact is consequently underestimated. Size dependent models of spatial distribution of cloud drops that simulate the observed power laws show strong drop clustering, the more so the larger the drops. The degree of clustering is determined by the observed exponents. The strong clustering of large drops arises naturally from the observed power-law statistics. Current theories of photon-cloud interaction and warm rain formation will need radical revision in order to produce these statistics; their underlying equations are unable to yield the observed power law.
Author
Atmospheric Radiation; Cloud Physics; Drops (Liquids); Variability; Geophysics

20040095320 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Accuracy and Precision in the Southern Hemisphere Additional Ozonesondes (SHADOZ) Dataset in Light of the JOSIE-2000 Results
Witte, Jacquelyn C.; Thompson, Anne M.; Schmidlin, F. J.; Oltmans, S. J.; Smit, H. G. J.; January 2004; 1 pp.; In English; International Quadrennial Ozone Symposium, 1-8 Jun. 2004, Kos, Greece; Copyright; Avail: Other Sources; Abstract Only

Since 1998 the Southern Hemisphere ADditional OZonesondes (SHADOZ) project has provided over 2000 ozone profiles over eleven southern hemisphere tropical and subtropical stations. Balloon-borne electrochemical concentration cell (ECC) ozonesondes are used to measure ozone. The data are archived at: &ttp://croc.gsfc.nasa.gov/shadoz\g. In analysis of ozonesonde imprecision within the SHADOZ dataset, Thompson et al. [JGR, 108,8238,20031 we pointed out that variations in ozonesonde technique (sensor solution strength, instrument manufacturer, data processing) could lead to station-to-station biases within the SHADOZ dataset. Imprecisions and accuracy in the SHADOZ dataset are examined in light of new data. First, SHADOZ total ozone column amounts are compared to version 8 TOMS (2004 release). As for TOMS version 7, satellite total ozone is usually higher than the integrated column amount from the sounding. Discrepancies between the sonde and satellite datasets decline two percentage points on average, compared to version 7 TOMS offsets. Second, the SHADOZ station data are compared to results of chamber simulations (JOSE-2000, Juelich Ozonesonde Intercomparison Experiment) in which the various SHADOZ techniques were evaluated. The range of JOSE column deviations from a standard instrument (-10%) in the chamber resembles that of the SHADOZ station data. It appears that some systematic variations in the SHADOZ ozone record are accounted for by differences in solution strength, data processing and instrument type (manufacturer).
Author
Southern Hemisphere; Ozone; Data Processing

20040095332 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Amplitude Scintillation due to Atmospheric Turbulence for the Deep Space Network Ka-Band Downlink
Ho, C.; Wheelon, A.; Interplanetary Network Progress Report; August 15, 2004; Volume 42-158, pp. 1-21; In English
Report No.(s): IPN-PR-42-158; No Copyright; Avail: CASI; A03, Hardcopy

Fast amplitude variations due to atmospheric scintillation are the main concerns for the Deep Space Network (DSN) Ka-band downlink under clear weather conditions. A theoretical study of the amplitude scintillation variances for a finite

aperture antenna is presented. Amplitude variances for weak scattering scenarios are examined using turbulence theory to describe atmospheric irregularities. We first apply the Kolmogorov turbulent spectrum to a point receiver for three different turbulent profile models, especially for an exponential model varying with altitude. These analytic solutions then are extended to a receiver with a finite aperture antenna for the three profile models. Smoothing effects of antenna aperture are expressed by gain factors. A group of scaling factor relations is derived to show the dependences of amplitude variances on signal wavelength, antenna size, and elevation angle. Finally, we use these analytic solutions to estimate the scintillation intensity for a DSN Goldstone 34-m receiving station. We find that the (rms) amplitude fluctuation is 0.13 dB at 20-deg elevation angle for an exponential model, while the fluctuation is 0.05 dB at 90 deg. These results will aid us in telecommunication system design and signal-fading prediction. They also provide a theoretical basis for further comparison with other measurements at Ka-band.
Author
Amplitude Modulation; Scintillation; Atmospheric Turbulence; Deep Space Network; Downlinking; Bands

48
OCEANOGRAPHY

Includes the physical, chemical and biological aspects of oceans and seas; ocean dynamics; and marine resources. For related information see also *43 Earth Resources and Remote Sensing*.

20040086548 Oregon State Univ., Corvallis, OR, USA
Jason 1 Investigation: Altimetric Studies of Ocean Tidal Dynamics
Egbert, Gary D.; June 30, 2004; 4 pp.; In English
Contract(s)/Grant(s): NCC5-711
Report No.(s): NS141A; No Copyright; Avail: CASI; A01, Hardcopy

Two papers on tidal dissipation were completed and published. The first of these extended our earlier work, which focused on the dominant M2 constituent, to include 7 additional constituents. In addition to confirming a total deep water dissipation total very close to 1 TW, this study demonstrated significant differences in the distribution of dissipation between diurnal and semi-diurnal constituents. The second paper involved an extensive modeling study of tides in the present day and the last glacial maximum. In this study we showed that accuracy of tidal solutions for the present day Ocean were significantly improved by including a parameterization of internal tide drag over rough topography in the deep ocean. It was also demonstrated that a complete self-consistent treatment of Ocean self attraction and tidal loading was required for accurate solutions.
Author
Ocean Dynamics; Ocean Surface; Tides; Topography; Space Missions; Satellite Altimetry

20040086706 Colorado Univ., Boulder, CO, USA
Infrared and Passive Microwave Radiometric Sea Surface Temperatures and Their Relationships to Atmospheric Forcing
Castro, Sandra L.; August 10, 2004; 9 pp.; In English
Contract(s)/Grant(s): NAG5-10791; No Copyright; Avail: CASI; A02, Hardcopy

The current generation of infrared (IR) and passive microwave (MW) satellite sensors provides highly complementary information for monitoring sea surface temperature (SST). On the one hand, infrared sensors provide high resolution and high accuracy but are obscured by clouds. Microwave sensors on the other hand, provide coverage through non-precipitating clouds but have coarser resolution and generally poorer accuracy. Assuming that the satellite SST measurements do not have spatially variable biases, they can be blended combining the merits of both SST products. These factors have motivated recent work in blending the MW and IR data in an attempt to produce high-accuracy SST products with improved coverage in regions with persistent clouds. The primary sources of retrieval uncertainty are, however, different for the two sensors. The main uncertainty in the MW retrievals lies in the effects of wind-induced surface roughness and foam on emissivity, whereas the IR retrievals are more sensitive to the atmospheric water vapor and aerosol content. Average nighttime differences between the products for the month periods of January 1999 and June 2000 are shown. These maps show complex spatial and temporal differences as indicated by the strong spatially coherent features in the product differences and the changes between seasons. Clearly such differences need to be understood and accounted for if the products are to be combined. The overall goals of this project are threefold: (1) To understand the sources of uncertainty in the IR and MW SST retrievals and to characterize the errors affecting the two types of retrieval as a fiction of atmospheric forcing; (2) To demonstrate how representative the

temperature difference between the two satellite products is of Delta T; (3) To apply bias adjustments and to device a comprehensive treatment of the behavior of the temperature difference across the oceanic skin layer to determine the best method for blending thermal infrared and passive microwave measurements of SSTs.
Author (revised)
Sea Surface Temperature; Satellite-Borne Instruments; Infrared Detectors; Microwave Sensors

51
LIFE SCIENCES (GENERAL)

Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance of animals and plants in space and related environmental conditions. For specific topics in life sciences see *categories 52 through 55*.

20040086113 Duke Univ., Durham, NC
The Role of the Polypyrimidine Tract Binding Protein on CD44 Splicing in Breast Cancer
Baraniak, Andrew; Garcia-Blanco, Mariano A.; Jun. 2003; 144 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0236
Report No.(s): AD-A424409; No Copyright; Avail: CASI; A07, Hardcopy

The cytogenetic and nuclear changes during breast tumor progression have been well documented, but the causes of these alterations are poorly understood. Changes in estrogen receptor status, gain in metastatic potential, accumulation of PNCs, and differential splicing of genes are changes seen in breast cancer cells during tumor progression. A strong connection between the splicing machinery and these subtle, significant, changes in gene expression have yet to be documented. Likely candidates are the alternative splicing factors, most notably the Polypyrimidine Tract Binding Protein (PTB). PTB is a known repressor of exon definition. During breast cancer progression, we believe, PTB's ability to repress exons is altered. To understand the changes in PTB function as cancer cells de-differentiate, an understanding of PTB mechanism must be attained. We are using the regulation of FClFR2 exon In, as a model system to study PTB mediated repression. We have mapped pTB binding sites and through the use of heterologous recruitment and RNAi mediated pTB depletion have clearly demonstrated PTB's function in the exon 11th repression. Furthermore, we have defined the cell-type specific cis-regulatory elements responsible for overcoming PTB repressive effects and have identified a potential trans- acting factor, Fox-1, that has been reported to antagonize FTB.
DTIC
Cancer; Mammary Glands; Proteins; Sites; Splicing

20040086117 Army War Coll., Carlisle Barracks, PA
A Strategy for Improving the National Medical and Public Health Surge Capacity
Short, Jeffrey E.; Mar. 19, 2004; 35 pp.; In English
Report No.(s): AD-A424415; No Copyright; Avail: CASI; A03, Hardcopy

After the terrorist attacks of 11 September 2001 and the anthrax letters in October of that year there were significant efforts to improve the national public health infrastructure. In May 2003 the Federal Government sponsored a coordinated federal state and local exercise entitled Top Officials II (TOPOFF II). It was designed to exercise and test the coordinated public health and medical response to multiple geographically dispersed disaster events. Significant deficiencies in the public health and medical response to catastrophes persisted. The White House then directed the Department of Health and Human Services (DHHS) to develop a strategy for improving the nation's medical and public health surge capacity to deal with the medical consequences of a terrorist attack. This paper examines the strengths and weaknesses of current strategic efforts suggests several additional strategies to ensure immediate and long-term improvements and proposes a medical surge capacity network utilizing Department of Veterans Affairs and Department of Defense assets that can provide the nation a specialized bioterrorism capability.
DTIC
Public Health; Surges

20040086120 Arizona State Univ., Tempe, AZ
Impact of a Self-Management Education on Health Outcomes and Quality of Life in Child Asthma
Hall, Gerald W., Jr.; May 2004; 97 pp.; In English
Report No.(s): AD-A424421; CI04-372; No Copyright; Avail: CASI; A05, Hardcopy

According to the National Center for Health Statistics (2001) in 1998, 3.8 million children aged 0-17 years had an asthmatic episode. Nationally the asthma population is 6.3%. Arizona has exceeded the national asthma rates for 1991-1998 with an incidence of approximately 7% of the population. Asthmatic children require self-management instruction about asthma, medications, symptoms, and proper self-management. Poor self-management results from a lack of competence over asthma related self-management skills. This study defined self-management skill as those skills an asthmatic must have for competence in management. The purpose of this study was to test a self- management education program designed to enhance the self-management skill of inner city children with asthma in order to improve their health outcomes and quality of life. Measurement of effect in health outcomes and quality of life (QOL) were the indicators of competency in self-management skill. The pediatric asthma-specific questionnaire by Juniper and Guyatt (2001) examines QOL. Thurber and Blue (1994) developed the Asthma Self-care questionnaire to measure health outcomes. The pilot study design utilized a quasi-experimental design with pretest/posttest and non random assignment of subjects measured the differences in health outcomes and QOL of asthmatic children. Data collection was at three inner city Phoenix public schools. The analysis examined the * independent variable influence of self-management education on the dependent variable impact on quality of life and health outcomes.
DTIC
Asthma; Children; Education; Health; Signs and Symptoms; Social Factors

20040086123 Space and Naval Warfare Systems Center, San Diego, CA
Effects of Intense Pure Tones on the Behavior of Trained Odontocetes
Finneran, J. J.; Schlundt, C. E.; Feb. 2004; 22 pp.; In English
Contract(s)/Grant(s): Proj-DN305062
Report No.(s): AD-A424426; TR-1913; No Copyright; Avail: CASI; A03, Hardcopy

This report presents behavioral responses of dolphins and white whales exposed to 1-s tones. The U.S. Office of Naval Research (ONR) and Chief of Naval Operations (CNO) (N45) have sponsored research programs to investigate the auditory effects of high intensity sounds on marine mammals. In addition to auditory effects, these studies reported behavioral reactions as the subjects were exposed to sounds of increasing intensity. The most common reactions were attempts by the subjects to avoid the site of previous noise exposures, or attempts to avoid an exposure in-progress. Schlundt et al.* gave a brief summary of the more significant behavioral changes they observed in dolphins and white whales exposed to intense pure tones. This report presents a more detailed summary of behavioral responses of dolphins and white whales exposed to 1-s tones. *(Schlundt, C. E., Finneran, J. J. , Carder, D. A., and Ridgway, S. H. (2000). 'Temporary shift in masked hearing thresholds (MTTS) of bottlenose dolphins, Tursiops truncatus, and white whales, Deiphinapterus leucas, after exposure to intense tones,' J. Acoust. Soc. Am. 107(6), 3496-3508.)
DTIC
Animals; Auditory Signals; Dolphins; Mammals; Marine Biology; Whales

20040086130 Technology Assessment and Transfer, Inc., Annapolis, MD
Quasicrystalline Films for Tribological Applications: Role of Stoichiometry Microstructure Transformation Kinetics and Oxide Structure and Chemistry
Palaith, David; Jun. 30, 2004; 48 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-02-C-0043
Report No.(s): AD-A424452; No Copyright; Avail: CASI; A03, Hardcopy

Significant progress was made towards an understanding of phase development and oxidation in the AlCuFe quasicrystalline system. Microstructure analysis by synchrotron diffraction exhibited the route for phase formation from the as-deposited precursor films. Formation of the R-phase occurred at 450 degree, below the previously published value of 475 degree. Preferential oxidation occurs in the near-surface region and temporarily disrupts formation of the R-phase microstructure, despite encapsulation in argon atmosphere. Fluctuation microscopy and other structural analysis showed the presence of an ordered, polycrystalline oxide on the surface of AlCuFe films annealed at 500 degree to 600 degree. This oxide film appeared to consist of aluminum oxide, and lacked copper and iron. The combination of microstructure analysis, phase development on annealing, and analysis of the oxide phase provided fundamental understanding of AlCuFe quasicrystalline coatings in steam engine applications. A tribological testing system capable of operating in a high temperature, steam environment was modified and tested. Room ambient and 100 degree steam Testing of Sb-impregnated graphit-hard ceramic combinations supported the high temperature steam test results at Enginion.
DTIC
Kinetics; Microstructure; Oxides; Stoichiometry; Structural Analysis; Tribology

20040086131 Burnham Inst., La Jolla, CA

Are Diadenosine Polyphosphates and/or FHIT Involved in Anoikis?

Frisch, Steven M.; Jun. 2004; 10 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0167

Report No.(s): AD-A424453; No Copyright; Avail: CASI; A02, Hardcopy

The FHIT (Fragile Histidine Triad) protein is an intriguing protein having certain properties of a tumor suppressor protein. The FHIT gene is altered in a large fraction of both sporadic and familial human breast cancers, genetically supporting its tumor gene status. Indeed, FRIT knockout mice have elevated frequency of various tumor types, consistent with this. The overexpression of the FHIT protein through recombinant adenovirus vector infection induces apoptosis and thus suppresses tumor growth, suggesting a more specific role for FRIT in apoptosis control. Yet, the biochemical activity and biologic function of PHIT protein are unknown at present, other than the fact that it binds and hydrolyzes the diadenosine polyphosphates Ap3A and Ap4A - molecules that accumulate in response to cellular stress. In this project we have focused on the potential role of FHIT in controlling one particularly cancer relevant apoptotic response - anoikis. Anoikis is the apoptotic response to cell- matrix detachment. It prevents mammary epithelial cells from colonizing in novel locations (i.e., metastasizing), thereby playing an important role in restricting mammary tumor progression that is often compromised in tumor cells. We have found that FHIT protein does not appear to play a role in anoikis, or, more generally, in apoptosis, prompting a re- examination of its actual cellular function. In the course of this project, however, we found a critical role for caspase-2 in anoikis.

DTIC

Cancer; Cells (Biology); Histidine; Mammary Glands

20040086139 Air Force Inst. of Tech., Wright-Patterson AFB, OH

Support Vector Machine and Parametric Wavelet- Based Texture Classification of Stem Cell Images

Jeffreys, Christopher G.; May 14, 2004; 122 pp.; In English

Report No.(s): AD-A424467; AFIT-CI04-435; No Copyright; Avail: CASI; A06, Hardcopy

Stem cell research is one of the most promising and cutting-edge fields in the medical sciences. It is believed that this innovative research will lead to lifesaving treatments in the coming years. As part of their work, stem cell researchers must first determine which of their stem cell colonies are of sufficiently high quality to be suitable for experimental studies and therapeutic treatments. Since colony texture is a major discriminating feature in determining quality, we introduce a non-invasive, semi-automated texture- based stem cell colony classification methodology to aid researchers in colony quality control. We first consider the general problem of textural image segmentation. In a new approach to this problem, we characterize image texture by the subband energies of the image's wavelet decomposition, and we employ a non-parametric support vector machine to perform the classification that yields the segmentation. We also adapt a parametric wavelet-based classifier that utilizes the Kullback- Leibler distance. We apply both methods to a set of benchmark textural images, report low segmentation error rates and comment on the applicability of and tradeoffs between the non- parametric and parametric segmentation methods. We then apply the two classifiers to the segmentation of stem cell colony images into regions of varying quality. This provides stem cell researchers with a rich set of descriptive graphical representations of their colonies to aid in quality control. From these graphical representations, we extract colony-wise textural features to which we add colony-wise border features. Taken together, these features characterize overall colony quality. Using these features as inputs to a multiclass support vector machine, we successfully categorize full stem cell colonies into several quality categories. This methodology provides stem cell researchers with a novel, non- invasive quantitative quality control tool.

DTIC

Image Classification; Image Processing; Textures; Wavelet Analysis

20040086160 California Univ., Davis, CA

Optimization and Characterization of Prostate Cancer Targeting Peptides

Marik, Jan; Lam, Kit; Feb. 2004; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0110

Report No.(s): AD-A424506; No Copyright; Avail: CASI; A02, Hardcopy

The annual report for postdoctoral traineeship awards 'Optimization and Characterization of Prostate Cancer Targeting Peptides' covers the period 02/01/ 2003-01/31/2004. During the first year, the combinatorial libraries proposed in specific aim 1 were synthesized and screened for DU-145, LNCap, PC3 cell binding (specific aim 2). The libraries were tested for binding of other cancer cell lines such as ovarian, lung and pancreatic cancer cell lines. Several high affinity ligands were identified for ovarian and lung cancer cell lines, but only weak binding ligands for prostate carcinoma cell lines were identified. The

following structure activity experiments (specific aim 3) were performed with ligands for DU-145 found previously and resulted in identification of essential amino acids. Furthermore, this ligand has been found to be specific for the prostate carcinoma cell line DU-145. Based on the results of structure activity study the next generation of combinatorial libraries are being synthesized.
DTIC
Cancer; Peptides; Prostate Gland

20040086162 Massachusetts Univ., Amherst, MA
Development of Spontaneous Mammary Tumors in BALB/c-p53+/-Mice: Detection of Early Genetic Alterations and the Mapping of BALB/c Susceptibility Genes
Smith, Sallie; Jerry, Joseph; Jan. 2004; 11 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0315
Report No.(s): AD-A424523; No Copyright; Avail: CASI; A03, Hardcopy

The TP53 tumor suppressor gene is defective in the majority of sporadic breast cancers, and breast cancer is the most frequent tumor type in women with Li-Fraumeni syndrome and bear germline mutations in TP53. We have used BALB/c-Trp53+/- mice as a model of Li- Fraumeni syndrome to follow the pathogenic changes in mammary glands of BALB/c-Trp53+/- mice and map genes that can alter sensitivity to mammary tumors. Normal mammary tissues from BALB/c-Trp53+/- mice did not reveal gross karyotypic instability or gross hyperproliferative changes. Hyperplastic tissues and intraepithelial neoplasias retained the wild type allele of Trp53 and expressed estrogen receptors. However, transition to invasive lesions was accompanied by a loss of the wild type allele of Trp53 and loss of estrogen receptor. Though BALB/c-Trp53+/- mice develop spontaneous mammary tumors, C57BL/6- Trp53+/- mice are resistant. A genome pan has identified a low- penetrance modifier locus on mouse chromosome 7. Fine mapping of the region of interest is being undertaken.
DTIC
Cancer; Genes; Genetics; Mammary Glands; Neoplasms; Tumors

20040086165 Duke Univ., Durham, NC
Reaper-Induced Cytochrome C Release
Olson, Michael R.; Aug. 2003; 24 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0232
Report No.(s): AD-A424527; No Copyright; Avail: CASI; A03, Hardcopy

Apoptosis is a program of cellular suicide which leads to the removal of damaged or superfluous cells without damaging overall tissue architecture. This grant concerns apoptotic induction by a 65 amino acid protein called Reaper form Drosophila melanogaster. Reaper was originally identified in a screen for critical apoptotic regulators in flies and it was later shown by our lab and others the Reaper can induce cell death upon ectopic expression in cells of both lepidopteran and vertebrate origin. In characterizing Reaper using our cell free apoptotic reconstitution system derived from Xenopus eggs, we identified a Reaper-interacting protein called Scythe that promoted cytochrome c release form the mitochondria. The goal of the proposed research has been to determine the mechanism whereby Reaper and Scythe cooperate to induce mitochondrial cytochrome c release and eventual cell death.
DTIC
Apoptosis; Cells (Biology); Cytochromes

20040086166 Florida Univ., Gainesville, FL
Angiogenesis and Therapeutic Approaches to NF1 Tumors
Muir, David F.; Apr. 2004; 10 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0225
Report No.(s): AD-A424529; No Copyright; Avail: CASI; A02, Hardcopy

The main goal of this project is to specify how anti-angiogenic approaches can be effectively applied to NFl tumors. To this end, we will first determine whether NF1 heterozygosity alters the responsiveness of endothelial cells to angiogenic regulators. We will test if Nfl -1+ endothelial cells are particularly responsive to pro-angiogenic factors produced by NF1 tumor cells and, perhaps even more importantly, which anti-angiogenic factors are most effective in abrogating the angiogenic response evoked by NF1 tumors. In particular, endostatin will be thoroughly examined as a potential anti-angiogenic therapy for NF1 tumors. Gene therapy for NF 1 tumors has not been tested due to the lack of an appropriate NF1 tumor model. We have established a working xenograft model of neurofibroma in the mouse in which the efficacy of endostatin gene therapy

will be accessed. This model involves the initiation of neurofibromas by implantation of human NF1 tumor-derived, neurofibromin-null Schwann cells into the nerves of mice with an Nfl - /+ background. Tumor progression and vascularity will be assessed in vivo by MRI non-invasive imaging. MRI data will be corroborated by end- point histology using precise labeling of tumor and host cell components.
DTIC
Gene Therapy; Neoplasms; Therapy; Tumors

20040086170 University of South Florida, Tampa, FL
The Role of the Prohibitin Gene in Apoptosis of Breast Cancer Cells
Fusaro, Gina; Chellappan, Srikumar; Oct. 2003; 39 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0215
Report No.(s): AD-A424534; No Copyright; Avail: CASI; A03, Hardcopy

Prohibitin, a potential tumor suppressor protein, was originally identified by its ability to induce Gl/S arrest in human fibroblasts. Mutations in the prohibitin gene were subsequently found in sporadic breast tumors. Our experiments in B cells and breast cancer cells suggest that prohibitin protects against apoptosis induced by camptothecin, a topoisomerase I inhibitor. A human B cell line (Ramos) stably over-expressing prohibitin and treated with camptothecin exhibits 50% less apoptosis compared to the parental cell line. BT 549 breast cancer cells, which express high levels of endogenous prohibitin, exhibit 20% less death from camptothecin than ZR 751 cells, which have low levels. E2F transcriptional activity increases in response to camptothecin, but this increase is attenuated in cells overexpressing prohibitin. Moreover, we find that prohibitin and p33 associate in vitro and co-localize in the breast cancer cell lines MCF7 and T47D. Functionally, prohibitin may activate p53 mediated transcription and augment p53 binding to a target promoter. Prohibitin may intersect both the Rb/E2F and the p53 pathways, providing a link between proliferation and growth control. Our studies are elucidating the mechanisms whereby prohibitin affects the chemotherapeutic response and may help in directing therapeutic strategies for breast cancer treatment.
DTIC
Apoptosis; Cancer; Fibroblasts; Mammary Glands

20040086175 Mayo Clinic, Jacksonville, FL
New Inhibitors of the Peripheral Site in Acetylcholinesterase that Specifically Block Organophosphorylation
Rosenberry, Terrone L.; Apr. 2004; 23 pp.; In English
Contract(s)/Grant(s): DAMD17-02-2-0024
Report No.(s): AD-A424552; No Copyright; Avail: CASI; A03, Hardcopy

Examination of the enzyme structure for acetylcholinesterase (AChE) reveals two sites of ligand interaction: The peripheral site (P-site) located at the entrance of the gorge, and the acylation site (A-site) at the base of the gorge. Our goal is to develop high affinity cyclic peptide ligands specific for the P-site that would block the access of organophosphate agents while allowing the passage of acetylcholine to the A-site for use by personnel at risk for nerve gas exposure. Our immediate strategy involves the covalent tethering of cyclic inhibitors via a methanethiosulfonate (MTS) linkage to a cysteine on the AChE mutant, H287C. We are using a combinatorial approach to identify tethered cyclic peptides with high affinity for the P- sfte. The modified AChEs linked to candidate peptides that inhibit P-site access are selected by affinity chromatography. We are developing mass spectrometry techniques to determine the peptide structure of these candidates. These include release of the cyclic peptide by reduction with DTT and peptide sequencing by 1 dimensional liquid chromatographic ESI ion-trap mass spectrometry. This method should provide the peptide amino acid sequence through its MSn capabilities, which allow for peptide fragment analysis through several stages of consecutive collisionally activated decomposition (CAD) mass spectra.
DTIC
Acetyl Compounds; Cholinesterase; Inhibitors; Organic Phosphorus Compounds

20040086178 Virginia Univ., Charlottesville, VA
Increasing Mammographic Breast Density in Response to Hormone Replacement Therapy and Breast Cancer Risk
Harvey, Jennifer A.; Oct. 2003; 58 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0442
Report No.(s): AD-A424557; No Copyright; Avail: CASI; A04, Hardcopy

Hormone replacement therapy (HRT) use is associated with a small increased risk of developing breast cancer. Currently, it is not possible to predict which women using HRT are at increased risk of developing breast cancer. HRT causes an increase in mammographic density in 17-37% of women. Women with increased mammographic density are also known to be at

increased risk for developing breast cancer. We therefore hypothesize that women who have an increase in mammographic density in response to HRT. The purpose of this case-control study is to determine if an increase in mammographic density in response to HRT is associated with an increased risk of breast cancer. Breast cancer cases at our institution between 1990-2000 will be evaluated, identifying postmenopausal women using HRT at the time of diagnosis. These women will be matched (1:2, case: control) by age and year of mammogram. Clinical data will be collected. Change in breast density over time will be assessed using quantitative digital analysis. Odds ratios will estimate the association between HRT-associated increase in breast density and risk of breast cancer.
DTIC
Cancer; Hormones; Mammary Glands; Replacing; Risk; Therapy

20040086180 Burnham Inst., La Jolla, CA
Regulation of Apoptosis in Breast Cancer by NF- KappaB and IAB Axis
Jul. 2003; 28 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0169
Report No.(s): AD-A424561; No Copyright; Avail: CASI; A03, Hardcopy

Defects in apoptosis contribute to the pathogenesis and progression of breast cancer. One of the modulators of apoptosis is NF-KappaB, a family of heterodimeric transcription factors containing a conserved REL homology domain. Apoptosis relevant targets of NF-KappaB include Bfl-1, bcl-X(sub L), FLIP, cIAP2, and others. We sought to identify novel regulators of NF-KappaB. We identified novel members of a family of PAAD/PYRIN domain- containing proteins, called PAs2 and NAC. These proteins modulate activity of the I-KappaB kinases (IKKs). Discovery of these novel NF-KappaB regulators provides new insights into mechanisms of apoptosis regulation and also may be of relevance to immune responses to breast cancers.
DTIC
Apoptosis; Cancer; Genetics; Mammary Glands; Proteins

20040086183 Pittsburgh Univ., Pittsburgh, PA
Elevated Levels of Somatic Mutation as a Biomarker of Environmental Effects Contributing to Breast Carcinogenesis
Grant, Stephen G.; Jul. 2003; 79 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0409
Report No.(s): AD-A424567; No Copyright; Avail: CASI; A05, Hardcopy

It is widely presumed that environmental exposures play a role in the development of breast cancer, but few individual agents have been unequivocally identified as risk factors. Rather than seek out individual agents, we hypothesize that the cumulative effect of environmental exposures on an individual can be quantified through a blood- based assay, and further, that such a 'biomarker' might distinguish breast cancer patients from age-matched controls. Preliminary evidence seems to support this hypothesis, and we have now begun to supplement this preliminary data in a manner that will allow us to determine how environmental exposures and predisposition interact with other known risk factors for breast cancer, such as family history, life history of hormonal exposure, and exposure to ionizing radiation. These biomarker data can then be added to a risk assessment procedure for breast cancer, and ultimately, might help identify the types of exposure specifically associated with cancer in the breast.
DTIC
Biomarkers; Cancer; Carcinogens; Environment Effects; Mammary Glands; Mutations

20040086185 General Hospital Corp., Boston, MA
Role of Oocyte Loss in Ovarian Surface Mesothelial Cell Transformation
Tilly, Jonathan L.; Nov. 2003; 11 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0567
Report No.(s): AD-A424569; No Copyright; Avail: CASI; A03, Hardcopy

Three Specific Aims (SA) were proposed to test in mice if accelerated oocyte loss caused by Bclw deficiency or Bax gain-of-function drives ovarian surface mesothelial cell (OSMC) transformation: 1) characterize preneoplastic changes in OSMC of Bclw(-/-)1 mice with increasing age; 2) determine if disruption of the gene encoding Bax rescues the compromised oocyte survival and the OSMC transformation phenotype in aging Bclw(-/-) mice; and, 3) test if targeting overexpression of Bax to only growing oocytes accelerates oocyte depletion and causes OSMC transformation. To date, we have confirmed the occurrence of OSMC transformation in aging Bclw mutants, but there is no progression to invasive carcinoma by 20+ months

of age (SA 1). Inactivation of Bax restores the compromised oocyte endowment in neonatal Bclw mutants to normal, but this protective effect on the oocyte pool is lost in young adult females (SA2). We have constructed a zp3-Bax minigene and have begun to generate transgenic mice expressing Bax only in growing oocytes (SA 3). Finally, we have shown in another mouse model that accelerated oocyte loss is directly involved in ovarian tumorigenesis. In addition, we have demonstrated a direct growth inhibitory effect of oocytes on human ovarian cancer cells in vitro.
DTIC
Cancer; Losses; Ovaries

20040086186 John Wayne Inst. for Cancer Treatment and Research, Santa Monica, CA
Serum DNA Microsatellites as Surrogate Genetic Markers of Breast Cancer Progression
Hoon, Dave S.; Oct. 2003; 11 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0279
Report No.(s): AD-A424571; No Copyright; Avail: CASI; A03, Hardcopy

The main objective of the study is the assessment of microsatellite markers with loss of heterozygosity (LOH) in serum, bone marrow (BM), and primary tumor. We will also be investigating circulating tumor cells in blood in this study. In our last report, we demonstrated the presence of LOH in the serum and BM of early stage breast cancer patients, found a significant concordance with those present in the primary tumor, and correlated the detection of serum LOH to primary tumors with increased proliferation indices and patients with advancing stage of disease. However, we were instructed by the Office of Regulatory Compliance and Quality, U.S. Army Medical Research and Materiel Command (the Office) in June of 2002 to discontinue our research work because of inadequacy in our Institutional Review Board approved patient inform consent documentations. We regret to report that there has been no progress since the notice from the Office. Instead, we have focused on making revisions, amendments, and submissions to both our Internal Review Board and the Office for approval on the protocol and consent form to comply with the Office's recommendations.
DTIC
Blood; Cancer; Deoxyribonucleic Acid; Genetics; Mammary Glands; Markers; Serums

20040086189 Luna Innovations, Inc., Blacksburg, VA
Monitoring the Decontamination of Bacterial Spores Using Fluorescent Viability Assays
Van Tassell, Roger L.; Sep. 12, 2002; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-03-C-0068
Report No.(s): AD-A424577; ARO-45512.1-CH; No Copyright; Avail: CASI; A03, Hardcopy

Plate count methods are used to determine the efficacy of decontaminants against pathogenic bacteria. However, they are costly, labor intensive and time-consuming. With recent concerns of biowarfare, a simple and rapid means for characterizing decontaminant formulations and monitoring clean up efforts are greatly needed. Luna has developed several fluorescence-based assays to monitor the viability of microbes such as E. coli, S. aureus and B. globigii, the anthrax simulant. Dose-response and time-course lethalities to decontaminants can be determined within 1-2 hours. During this special contract, Luna Innovations adapted the fluorescent viability assays to monitor the decontamination of bacterial spores. With the addition of an acceleration step, the resazurin viability assay monitored the lethal effects of decontaminants on spores of B. globigii with good correlation to decreases in plate counts (spores/ml). Spores were recovered from glass surfaces decontaminated with DF-200 and processed using a novel syringe/filter sampling format. By combining the acceleration step with the syringe/filter formats, as few as 5-50 spores were detected from swabbed surfacesin 8-10 hours. This rapid, fluorescence-based viability assay has been formatted for %high throughput' use with a fluorescent microplate reader and provides a rapid alternative to extensive primary plate count screening
DTIC
Assaying; Bacteria; Decontamination; Fluorescence; Microorganisms; Pathogens; Spores; Viability

20040086194 Texas Univ., Houston, TX
New Agents for Taxol-Resistant Ovarian Carcinoma
Klostergaard, Jim; Jul. 2003; 21 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0726
Report No.(s): AD-A424595; No Copyright; Avail: CASI; A03, Hardcopy

Taxol resistance is an important issue in relapsing ovarian cancer. Two approaches to address this resistance include the use of drug copolymers and drug targeting. In this proposal, paclitaxel covalently coupled to backbones of poly(L-glutamic)

acid (non- targeted) or hyaluronic acid (CD44 targeted) as prodrugs will be evaluated in CD44 over-expressing human ovarian carcinoma i.p. (orthotopic) xenografts. We have documented the high CD44 expression levels of several such models (HEY, NMP-l, SKOV-3 and SKOV-3i.p.). Further, all but the former present as multiifocal tumors in the peritoneal cavity, most relevant to an initially surgically debulked or relapsing patient. All lines were sensitive in vitro to Taxol and to PGA-TXL, and Taxol caused rapid activation of caspases. Further, we have shown that dimethyl-sphingosine, a potent inhibitor of sphingosine kinase that catalyzes the formation of pro- survival/anti-apoptotic sphingosine-l-phosphate, causes supra- additive cytotoxic interactions with Taxol on these lines. We will compare the antitumor efficacy of PGA-TXL and HA-TXL in these CD44 over-expressing ovarian tumor models, and also determine whether dimethyl-sphingosine can further reduce the apoptotic threshold in these tumors. These approaches may be important new tactics in addressing ovarian tumor chemoresistance.
DTIC
Cancer; Ovaries

20040086202 Duke Univ., Durham, NC
Structural and Functional Analysis of Androgen Receptor-DNA Interactions
Gewirth, Daniel T.; Feb. 2004; 8 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0050
Report No.(s): AD-A424611; No Copyright; Avail: CASI; A02, Hardcopy

Our objective is to use X-ray crystallography to determine the basis for specific interactions between the Androgen receptor and its DNA targets, in order to understand how the receptor can recognize two different bipartite DNA response elements with diametrically opposing arrangements. Our research has now identified a variant of the AR DNA binding domain that yields large, single lattice crystals when bound to a direct repeat response element. The 3-dimensional crystal structure of the androgen receptor (AR) DNA binding domain (DBD) bound to a selective ADR3, determined at 3.1 A resolution, reveals an unexpected head-to-head arrangement of the two promoters, rather than the expected head-to-tail arrangement seen in nuclear receptors bound to response elements of similar geometry. Compared to the glucocorticoid receptor (GR), the DBD dimmer interface of the AR has additional interactions that stabilize the AR dimmer and increase the affinity for non-consensus response elements. This increased interfacial stability compared to the other steroid receptors may account for the selective binding of AR to ADR3 response elements.
DTIC
Deoxyribonucleic Acid; Functional Analysis; Hormones; Males; Structural Analysis

20040086203 Northern California Inst. for Research and Education, San Francisco, CA
The Role of the Y-Located TSPY Gene in Prostatic Oncogenesis
Lau, Yun-Fai C.; Feb. 2004; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-1-0081
Report No.(s): AD-A424616; No Copyright; Avail: CASI; A03, Hardcopy

The TSPY gene is the only functional gene within the critical region harboring the gonadoblastoma locus on the Y chromosome (GBY). Expression studies demonstrated that it is aberrantly expressed in prostate cancer. This project is designed to address the role of this putative oncogene on the Y chromosome in this male-specific cancer. The objectives are: 1) to identify the oncogenic or tumor promoting domain in TSPY, and 2) to correlate TSPY over-expression with prostatic oncogenesis in transgenic mice. We have analyzed the expression of TSPY in additional cases of gonadoblastoma and samples from a tissue recombination model of human prostate cancer. Our results provide a detailed morphologic evolution of the oncogenic process in gonadoblastoma and demonstrated that TSPY expression is closely associated with oncogenesis. Using a tet-off system we demonstrated that expression of the different variants of TSPY proteins are capable of transforming cells at higher efficiencies and proliferating at faster rates than those without TSPY expression. The present research provides significant insights into the probable mechanism of TSPY function in oncogenesis.
DTIC
Cancer; Prostate Gland; Tumors

20040086212 Mayo Clinic, Rochester, MN
The Role of CBP/p300 in Breast Cancer Development
Deursen, Jan M. van; Sep. 2003; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0475
Report No.(s): AD-A424640; No Copyright; Avail: CASI; A03, Hardcopy

CBP and p300 are highly related mammalian transcriptional coactivators that regulate gene transcription through various activities (Goodman and Smolik, 2000). Both coactivators are known to enhance gene transcription by linking sequence-specific transcription factors to the RNA polymerase II holoenzyme (Kee et al., 1996; Nakajima et al., 1997). They also promote gene transcription by forcing chromatin into conformations that are more accessible to DNA binding transcription factors through the acetylation of histones (Ogryzko et al., 1996) . Besides histones, CBP and p300 also acetylate specific transcription factors. For instance, acetylation of p53 by CBP has been shown to enhance the DNA binding ability of p53 (Gu et al., 1997; Liu et al., 1999; Sakaguchi et al., 1998), and acetylation of CREB has been shown to stimulate CREB-mediated gene expression (Lu et al., 2003).
DTIC
Acetylation; Cancer; Genes; Mammary Glands; Proteins

20040086213 California Univ., Berkeley, CA
Impact of C-neu/erbB2 on Estrogen and Estrogen Receptor Alpha-Dependent Proliferation of Mammary Ductal Epithelial Cells
Shyamala, Gopalan; Oct. 2003; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0295
Report No.(s): AD-A424641; No Copyright; Avail: CASI; A03, Hardcopy

The objective of our research is to examine the expression patterns of estrogen receptor (ER-alpha), progesterone receptor (PR) and C-Neu in mammary glands of wild type and C-Neu transgenic mice during various developmental states and identify the relationships between these expression patterns to cells undergoing proliferation. In previous studies, we demonstrated that there were differences between the mammary glands of wild type and C-Neu mice with regard to their expression patterns of PR. And were apparent as early as six weeks of age. Our present studies reveal that mammary glands of c-neu mice contain abnormal structures with a high rate of proliferation and also that this is ovarian steroid/estrogen independent and detectable as early as 6 weeks of age. The average onset of mammary tumors in c-neu mice is approximately 30-32 weeks Yet, our studies, so far, indicate that c-neu dependent alterations in ovarian steroid hormonal regulation of mammary epithelial cells represent early events and not a late phenomenon associated with tumor progression We propose that estrogen independent proliferation may be intrinsic to mammary cells that over express c-neu. If so, both blocking erbB2 activity and the use of appropriate SERMS may be more beneficial in the clinical management of c- neu cancers.
DTIC
Cancer; Cells (Biology); Estrogens; Health; Mammary Glands; Receptors (Physiology)

20040086214 Johns Hopkins Univ., Baltimore, MD
Identification of Widely Applicable Tumor- Associated Antigens for Breast Cancer Immunotherapy
Bai, Jining; Oct. 2003; 15 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0280
Report No.(s): AD-A424642; No Copyright; Avail: CASI; A03, Hardcopy

This study is a feasibility study of a novel immunotherapeutic strategy for the treatment of breast cancer. The rationale is based upon recent findings that genes belonging to the pp32 family are differentially and alternatively expressed in most human breast cancers. In general, benign breast tissues express pp32, a tumor suppressor, whereas breast cancers express tumorigenic family members, including pp32rl and pp32r2. Since pp32rl and pp32r2 are expressed in nearly all breast cancers, but not in normal adult tissues, they may reasonable serve as targets for antigen-specific immunotherapy. The purpose of this study is to identify tumor-associated antigens (TAA) in pp32rl and pp32r2, then test their suitability in vitro as immunotherapeutic targets in breast cancer. Currently, the animal study is underway. If successful, the results may translate into eventual clinical trials of peptide vaccines or adoptive T cell therapy.
DTIC
Antigens; Cancer; Mammary Glands; Tumors

20040086215 Texas Univ., Dallas, TX
Characterization of a Putative Tumor Suppressor in Breast Cancer
Thomas, Jackie; White, Michael A.; Jun. 2003; 6 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0439
Report No.(s): AD-A424643; No Copyright; Avail: CASI; A02, Hardcopy

Telomerase activity is required to maintain telomere integrity on chromosomes of proliferating cells and thus is critically

involved in regulating cellular replicative lifespan. Telomerase is repressed in most adult somatic cells, and activation of telomerase activity is an early event associated with tumor progression. Expression of telomerase is sufficient to greatly prolong proliferative lifespan of human cells in culture. Because telomerase activity is not required to maintain viability of post- mitotic somatic cells, but is required to maintain the proliferative capacity of tumor cells, telomerase is an ideal target for anti-cancer therapies. Here we have produced mammalian expression vectors containing pol- driven short-hairpin siRNA precursors targeting hTERT mRNA. We show that these vectors dramatically repress telomerase activity when delivered to telomerase positive immortal human tumor cells, resulting in dramatic telomere shortening and a limited replicative life-span in culture.
DTIC
Cancer; Mammary Glands; Suppressors; Tumors

20040086216 Boston Univ., Boston, MA
Screening for Breast Cancer Using Near-Field Infrared Spectroscopy of a Single Strand of Hair
Erramilli, Shyamsunder; Hong, Mi K.; Dec. 2003; 12 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0159
Report No.(s): AD-A424644; No Copyright; Avail: CASI; A03, Hardcopy

This work was motivated by an Australian study that used synchrotron x-ray diffraction to identify changes in the structure of hair that may be linked to either the occurrence of breast cancer, or the increased predisposition to breast cancer because of the breast of a mutation of the BRCAl gene. In this study, we have successfully developed a new infrared method for the detection in a single strand of hair the presence of lipid deposits that were the putative cause of the observed x-ray patterns. Our method, which does not use synchrotron radiation, is based on a table-top infrared technique and provides an independent test of the proposed link between hair structure and breast cancer. Our tests show that we find the presence of lipids in healthy control patients as well. We performed independent x-ray studies in collaboration with researchers at Cornell University, who have confirmed our finding that the x-ray scattering patterns are observed in hair from healthy patients. Taken together our work suggests that (i) IR microscopy is promising, but (ii) the Australian study is wrong - a disappointing result for breast cancer.
DTIC
Cancer; Hair; Infrared Spectroscopy; Mammary Glands; Near Fields; Strands

20040086217 Texas Univ., Houston, TX
STK15/BTAK and Centrosome Anomaly in Human Breast Cancer
Sen, Subrata; Oct. 2003; 30 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0302
Report No.(s): AD-A424645; No Copyright; Avail: CASI; A03, Hardcopy

STK15/BTAk is a member of the Aurora/Ipll related serine/threonine kinase super family that is associated with centrosomes, exhibits elevated expression in many human cancers. Ectopic over expression of this kinase induces aneuploidy, centrosome amplification and tumorigenic transformation in cells grown in vitro. In the study conduced during this funded project, the findings are the following: a) The familial breast cancer susceptibility gene BRCA1, which co- localizes to centrosome during mitosis, interacts with STK15 in vivo and is phosphorylated by STK15 kinase immunoprecipitated from mitotic cells in in vitro kinase assays. W have mapped the STK15 binding domain on BRCA and have mapped the putative STK15 phosphorylation site on BRCA1. b) The tumor suppressor protein p53, which localizes to centrosome is phosphorylated by STK15 and this phosphorylation leads to destabilization and inhibition of p53. c) The central peptide domain of STK15 unnecessary for localization of this protein kinase to the centrosomes. Centrosome localization of STK15 is augmented by sequences of both the amino and the carboxy terminal ends of the protein.
DTIC
Anomalies; Cancer; Mammary Glands; Proteins

20040086218 Yale Univ., New Haven, CT
Targeting the Tumor Vasculature for Prostate Cancer Immunotherapy
Garen, Alan; Feb. 2004; 18 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0167
Report No.(s): AD-A424646; No Copyright; Avail: CASI; A03, Hardcopy

The efficacy and safety for prostate cancer immunotherapy of several Icon delivery systems were tested in

immunocompetent mice carrying the mouse prostatic tumor, and in SCID mice carrying a human prostatic tumor, as follows. (i) Alginate and thermosensitive gels containing Icon-producer CHO or BHK cells were injected subcutaneously or intratumorally. The procedures showed efficacy but the cells escaped from the gel to form nodules. (ii) 293 cells containing infected with an adenoviral vector encoding the Icon were injected subcutaneously or intratumorally. The procedures were efficacious and safe and will be studied further as promising delivery systems. (iii) Icon-producer mouse NIH-3T3 cells were inserted into a chamber and implanted inside a skinfold flap in the mouse. The cells secreted the Icon for about 7 weeks and inhibited tumor growth. This procedure could be continued for longer periods by periodic implantation of chambers with fresh cells. (iv) Intravenous injections of purified Icon protein, or intratumoral injections of an adenoviral vector encoding the Icon, into SCID mice carrying human prostate tumors resulted in long-term regression of the tumors without toxicity. We conclude that the delivery procedures for the Icon described in parts ii, iii and iv showed significant efficacy and safety in mouse models and should be developed for possible clinical use.
DTIC
Blood Vessels; Cancer; Prostate Gland; Tumors

20040086219 Duke Univ., Durham, NC
Enhancement of Prostate Cancer Radiotherapy by Immunogenetherapy
Li, Chuan-Yuan; Feb. 2004; 18 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0052
Report No.(s): AD-A424647; No Copyright; Avail: CASI; A03, Hardcopy

The goal of the proposed study is to develop a genetic immunotherapy strategy that can compliment and enhance current prostate cancer radiotherapy. The specific strategy that will be adopted in this proposal is to test the capacity of an adenovirus encoding immunostimulatory genes IL-12 and B7 to enhance the therapeutic effects of ionizing radiation in an experimental murine prostate tumor model TrampC. A substantial progress has been made towards this goal. We have now conducted experiments where we combined radiotherapy and genetic immunotherapy in the TrampC1 model. The results indicate synergistic effects in controlling subcutaneous tumor growth. In addition, we have also discovered that our immunogene therapy approach had a limited efficacy in controlling metastatic tumor growth. We explored the possibility that this limited success is due the in-efficiency of gene transfer by the viral vectors. Our results indicated that a novel, telomerase-targeted replicative gene therapy approach can significantly enhance the efficacy of the gene transduction into prostate cancer cells. We will explore this novel and exciting vector approach in the next year for our prostate cancer gene therapy approach.
DTIC
Augmentation; Cancer; Gene Therapy; Genes; Prostate Gland; Radiation Therapy

20040086220 Wayne State Univ., Detroit, MI
Development of Superagonist Mimics to Epitopes Defined by Cytotoxic and Helper T Cells
Mitchell, Malcolm S.; Aug. 2003; 13 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0453
Report No.(s): AD-A424648; No Copyright; Avail: CASI; A03, Hardcopy

Human mucin glycoprotein MUC1 is a ‘self’ peptide overexpressed on all surfaces of breast cancers and is an attractive candidate immunogen for a breast cancer vaccine. MUC1 is only weakly immunogenic, eliciting a low frequency of cytolytic T lymphocytes (CTL). We proposed to enhance immunity to MUC1 by using peptide mimics of native MUC1 epitopes. Mimic peptides contain amino acid substitutions; some mimics augment the T cell response to the native epitopes. The activity of mimics takes advantage of the degeneracy of T cell recognition, i.e., on the fact that a single T cell receptor (TCR) can recognize many different peptides. To develop MUC1 specific mimic peptides we planned to: 1) establish MUC1 specific CTL lines, 2) use combinatorial peptide libraries in a positional scanning format to determine which amino acid substitutions in the original peptide were recognized best by the CTL, 3) synthesize those mimics; 4) test them on an index cell line; and 5) identify those that were stronger immunogens for CTL than the native peptide. First we had to choose the best (most immunogenic) native MUC1 epitope and develop a CTL line from a healthy HLA-A*0201+ individual. Such a line had to be: (1) highly specific for chosen peptide, 2) strongly cytotoxic against MUC 1 positive adenocarcinoma cells, and (3) contain at least 10(exp 8) T cells. All of these qualities are required for successful analysis of the peptide library. Because MUC1 is a weak antigen, this first step proved to be very difficult, but we ultimately found a leader sequence LLLLTVLTV that consistently led to CTL and developed the CCM4 cell line. With this index cell line, we screened combinatorial nonamer libraries and identified amino acid substitutions that allowed better recognition of the peptides than the native. We then

synthesized 96 peptides containing as many as 8 substitutions. Unfortunately the CCM4 line did not survive frozen storage, so a new CTL line must be established.
DTIC
Antigens; Cancer; Cells (Biology); Immune Systems; Mammary Glands; Toxins and Antitoxins

20040086221 Lawrence Livermore National Lab., Livermore, CA
Protein Adducts of the Prostate Carcinogen PhIP in Children
Dingley, Karen H.; Feb. 2004; 27 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0076
Report No.(s): AD-A424649; No Copyright; Avail: CASI; A03, Hardcopy

Prostate cancer is the second leading cause of cancer death in men in the USA. A few epidemiology studies have indicated that exposure to PhIP, a rodent prostate carcinogen formed in meat during cooking, may be an important risk factor for prostate cancer in humans. Therefore, a highly sensitive biomarker assay is urgently needed to clarify the role of PhIP in prostate cancer. The goal of this project is to develop an assay that can be used to more accurately quantify human exposure to PhIP and potential prostate cancer risk. Our hypothesis is that an Accelerator Mass Spectrometry-based method can be developed to measure protein adducts of PhIP in the blood of humans. This will provide a measure of the internal dose, as well as the capacity for carcinogen bioactivation to a form that can initiate the cancer process. Towards this goal, we have characterized an adduct formed by PhIP in vitro with the amino acid cysteine. This adduct should provide a biomarker of dietary PhIP exposure and potential prostate cancer risk that could be used to identify individuals for prevention and for monitoring the effect of chemoprevention strategies.
DTIC
Adducts; Blood; Cancer; Carcinogens; Children; Prostate Gland; Proteins

20040086222 Naval Postgraduate School, Monterey, CA
Aligning Salary Expense and Workload Output In a Complex Military Medical System
Bills, Randy K.; Jun. 2004; 193 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424651; No Copyright; Avail: CASI; A09, Hardcopy

The National Naval Medical Center (NNMC), Bethesda, Maryland, set as a strategic goal the improvement of internal efficiency among its many clinical activities. Clinical services lacked the ability to improve their statistical process, which relied on workload and expense data. Since the data systems had removed provider identifiers, it was impossible to produce data on provider productivity and efficiency. Numerous efforts to improve the clinical staff's efficiency were unsuccessful because of data integration limitations. Clinical service managers could not review their clinical service staff roster nor maintain the correct coding of personnel because they did not nave access to the Standard Personnel Manpower System (SPMS) The step-wise approach business plan described in this thesis outlines the steps taken to generate productivity and efficiency feedback reports. These reports provided the clinical managers the necessary performance metrics to determine on a monthly basis now effectively their clinical services were operating.
DTIC
Clinical Medicine; Complex Systems; Medical Services; Military Operations; System Effectiveness; Workloads (Psychophysiology)

20040086223 Beth Israel Deaconess Medical Center, Boston, MA
Tamoxifen Dependent Interaction Between the Estrogen Receptor and a Novel P21 Activated Kinase
Balk, Steven P.; Jun. 2003; 8 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0149
Report No.(s): AD-A424652; No Copyright; Avail: CASI; A02, Hardcopy

The estrogen receptor a (Er-alpha) plays an important role in breast cancer and a large fraction of Er- alpha positive breast cancers respond to tamoxifen. We cloned a novel p21 activated kinase (PAK), termed PAK6, which binds to the androgen receptor (AR) and selectively to the tamoxifen liganded Era. PAKs are a family of serine/threonine kinases that bind to and are regulated by the Rho family small (p21) GTPases, Cdc42 and Rac. PAKS are involved in translating extracellular signals into cellular responses. Although PAK6 binds to Cdc42, it lacks the Cdc42 regulated autoinhibitory domain founding other PAKs and can instead be activated by steroid receptor binding. Binding is mediated by at least two sites on PAK6, one at the N-terminus and another toward the middle of the protein. PAK6 inhibits Er-alpha and AR transcriptional activity. PAK6 is highly expressed in brain and testes, is also expressed in mammary epithelium and prostate, and its expression in breast cancer

cell lines has been confirmed by a polyclonal antibody. Further studies of PAK6 protein expression in breast cancer are in progress, and breast cancer cell lines expression wildtype and mutant PAK6 have been generated to assess functions in breast cancer.
DTIC
Cancer; Cells (Biology); Estrogens; Mammary Glands

20040086224 Chicago Univ., Chicago, IL
Image Guidance and Assessment of Radiation Induced Gene Therapy
Pelizzari, Charles A\g; Feb. 2004; 59 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0034
Report No.(s): AD-A424653; No Copyright; Avail: CASI; A04, Hardcopy

Image guidance and assessment techniques are being developed for combined radiation/gene therapy, which utilizes a radiation-inducible gene promoter to cause expression of tumor necrosis factor alpha in irradiated tissues. TNF attacks vasculature, increasing the tumor killing effect of radiation. The radiation confines TNF toxicity to the irradiated region. This therapy has proven effective in several animal tumor models and phase I clinical trials. This project is developing imaging to visualize the effects of the combined modality therapy, by combining electron paramagnetic resonance imaging (EPRI), mapping oxygen concentration in 3D in vivo, and nuclear magnetic resonance imaging (MRI), measuring quantities such as vascular permeability and perfusion rate that reflect the status of vasculature. EPRI and MRI of prostate tumors in mice and rats will be conducted. Fusing the two sets of images from the same tumor before, during and after therapy, an image- derived signature will be developed which identifies regions responding well to therapy. In the final stage, this information will be used as the basis of an adaptive treatment regimen where regions that have responded less well will be given a boost, via image guided injection of additional gene vector prior to the next fraction of radiation.
DTIC
Gene Therapy; Image Analysis; Radiation Therapy

20040086225 Georgetown Univ., Washington, DC
Treatment Decision Making in Early-Stage Prostate Cancer: Evaluation of Computer-Based Patient Education and an Interactive Decision Aid
Taylor, Kathryn L.; Feb. 2004; 24 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0062
Report No.(s): AD-A424654; No Copyright; Avail: CASI; A03, Hardcopy

This study aims to examine a method of patient education for men who are seeking treatment for management of localized prostate cancer. The primary goal is to evaluate a recently developed computer-based educational tool (CD-ROM) that is designed to provide treatment- related information and to assist men in making an informed treatment decision. Once they are diagnosed with localized cancer, men are accrued post- biopsy for a baseline interview, and are randomized to receive a CD-ROM with a decision aid, or a CD-ROM with information only. To date, we have accrued and randomized 88 patients and study participation rate is currently 74.5%. We have had 16 men decline participation, 4 men withdraw from the study post- randomization, 5 men who we were never able to reach, and 5 men who are considered ‘missed’ as they had already made a concrete treatment decision by the time we contacted them. Two changes have been made to the study protocol since last year’s review and both changes have been approved by the Georgetown IRB and were submitted to the DOD on August 11, 2003. We are now accruing men post-biopsy, whereas we had previously tried to accrue pre-biopsy and we also added a 12-month follow-up interview.
DTIC
Cancer; Computer Assisted Instruction; Computer Techniques; Decision Making; Decision Support Systems; Education; Patients; Prostate Gland

20040086227 Dana Farber Cancer Inst., Boston, MA
Dynamics of Estrogen Receptor Transcription Complex Assembly in Breast Cancer
Hestermann, Eli V.; Jul. 2003; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0222
Report No.(s): AD-A424657; No Copyright; Avail: CASI; A03, Hardcopy

Estrogen plays a critical role in the development and progression of breast cancer. While endocrine therapies play an important part in breast cancer treatment, the failure of these therapies reflects a lack of knowledge concerning the molecular

mechanisms involved in estrogen signaling. The biological activities of estrogen are mediated by estrogen receptors (ER) . In addition, a large number of proteins termed cofactors are involved in ER signaling. Until recently, our knowledge regarding these cofactors was based on their ability to bind receptors in vitro and affect transcriptional activation in transfection experiments. The in vivo role of these cofactors and the specific target genes involved in breast cancer are not well known. Therapeutic agents, such as tamoxifen, also bind ER, but block proliferation in breast cells. However, tamoxifen increases the risk of endometrial cancer. We have used chromatin immunoprecipitation (ChIP) to investigate cofactor involvement in ER signaling in vivo and to understand the mechanisms underlying the different actions of tamoxifen in breast and endometrial cells. We are in the process of using ChIP to identify the set of genes regulated by ER and its cofactors in these tissues. The detailed understanding of tissue- and ligand-dependent changes in gene expression gained through these studies will lead to more effective therapies for ER-dependent breast cancer.
DTIC
Cancer; Estrogens; Mammary Glands

20040086229 Georgetown Univ. Hospital, Washington, DC
Testing Clinical Relevance and Therapeutic Potential of a Novel Secreted Ligand of TNF Family
Yang, Dajun; Sep. 2002; 18 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9209
Report No.(s): AD-A424660; No Copyright; Avail: CASI; A03, Hardcopy

LIGHT, a new member of TNF superfamily, is highly expressed in activated lymphocytes but not in cancer cells. Soluble LIGHT was proved to inhibit the growth of cancer cells expressing both LTBetaR and THVEM/TR2 receptors. Local LIGHT gene transfer suppresses in vivo tumor formation. The anti- cancer effect of LIGHT correlates with its up-regulation of intercellular adhesion molecule-1 (ICAM-l) expression of cancer cells. The up-regulation of ICAM-1 expression is not only at ICAM-1 protein trafficking level on cell surface as showed by flow cytometry analysis, but also at ICAM-1 total protein level as confirmed by Western blot. We further confirmed that LIGHT enhancement up-regulation of ICAM-1 expression is STAT1 and JAK1 dependent using STAT1 deficient U3A and JAK1 deficient E2A4 cells. LIGHT-induced apoptosis of cancer cells resulted in down-regulation of anti-apoptosis Bcl- 2 family members, such as Bcl-2, Bcl-X(L), Bag-1, and Mcl-1; up-regulation of pro-apoptosis Bcl-2 family member Bak. Extensive caspase activation is required in LIGHT- induced apoptosis of HT-29 colon cancer cells, but may not be required for LIGHT-induced apoptosis of MDA- MB-231 breast cancer cell. Activation of both DFF45 and PARP are involved in LIGHT- induced apoptosis. It was also proved that Bcl-2 down-regulation by LIGHT is STAT1 dependent.
DTIC
Cancer; Cells (Biology); Ligands; Mammary Glands; Therapy

20040086231 Minnesota Univ., Minneapolis, MN
Expression of Metabolic and Apoptotic Genes During Treatment With Chemopreventive Agents With Breast Cancer
Lu, Yongjian; Jul. 2003; 16 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0332
Report No.(s): AD-A424662; No Copyright; Avail: CASI; A03, Hardcopy

Metabolic and apoptotic genes underlying the effects of indole-3-carbinol (I3C) on breast cancer chemoprevetion were examined. A short-term (up to 10 days) treatment of rats with I3C at 5 or 25 mg/kg b.wt. ahs bee found to induce activities of caspase-3, -8, and -9 in the mammary gland, and at 250 mg/kg, upregulate the mRNA transcriptions of hepatic CYP1A1, 1B1, and 2B1/2 and mammary CYP1A1, and the oxidateive metabolism of 17b-estradiol and estrone by liver microsomes. Further, postcarcinogen treatment (thrice weekly for up to 20 weeks) of rats with tamoxifen (TAM) (10 microg/rat), I3C (250 mg/kg b.wt.) or TAM+I3C showed that the latency of malignant mammary tumors was significantly increased from 70 to 112 days in TAM- or TAM+I3C-treated rats compared to vehicle- or I3C treated rats. The mean number of malignant mammary tumors per rat was significantly decreased in the TAM-, I3C- or TAM+I3C-treated groups, and the mean tumor mass per rat was decreased in TAM-or TAM+I3C-treated groups. The data indicate that treatment with relatively low doses of TAM effectively suppresses mammary trumorigenesis, and TAM and I3C elicit cooperative effects in suppression of mammary tumor multiplicity. The mechanisms underlying the suppressing effects of I3C may vary at different dose levels.
DTIC
Apoptosis; Cancer; Genes; Health; Mammary Glands; Metabolism

20040086233 California Univ., San Diego, La Jolla, CA
Mechanism of Action of Substituted Indanones in Multidrug Resistant Breast Cancer
Leoni, Lorenzo M.; Sep. 2002; 28 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9100
Report No.(s): AD-A424665; No Copyright; Avail: CASI; A03, Hardcopy

Our laboratory has recently synthesized a series of novel substituted indanones that are selectively toxic to multidrug resistant cancer cells, including breast cancer cell lines. In this application we proposed to characterize the mechanism of action of indanocine and to assess the in vivo anti-tumor activity of indanocine. During the second year we: - published the second report on the biological activity of indanocine (Cancer Res 2001 Oct 1 61(1 9):7248-54) - analyzed the indanocine-resistant stable cell line -identified the potential indanocine-binding site on tubulin - continued the animal testing of indanocine - studies the pro-apoptotic mechanism of action in non-dividing tumor cells The results shown in this annual summary demonstrate that indanocine is a very promising new anti-cancer agent, with selective activity in slowly-dividing or quiescent tumor cells. The positive early animal models suggest that indanocine could be soon ready for clinical trials.
DTIC
Cancer; Chemotherapy; Drugs; Mammary Glands

20040086235 California Univ., San Diego, La Jolla, CA
Mechanism of Action of Substituted Indanones in Multidrug Resistant Breast Cancer
Leoni, Lorenzo M.; Sep. 2001; 28 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-99-1-9100
Report No.(s): AD-A424668; No Copyright; Avail: CASI; A03, Hardcopy

Our laboratory has recently synthesized a series of novel substituted indanones that are selectively toxic to multidrug resistant cancer cells, including breast cancer cell lines. In this application we proposed to characterize the mechanism of action of indanocine and to assess the in vivo anti-tumor activity of indanocine. During the second year we: - published the second report on the biological activity of indanocine (Cancer Res 2001 Oct 1;61(19):7248.54) - analyzed the indanocine-resistant stable cell line -identified the potential indanocine-binding site on tubulin - continued the animal testing of indanocine - studies the pro-apoptotic mechanism of action in non-dividing tumor cells The results shown in this annual summary demonstrate that indanocine is a very promising new anti-cancer agent, with selective activity in slowly-dividing or quiescent tumor cells. The positive early animal models suggest that indanocine could be soon ready for clinical trials.
DTIC
Cancer; Chemotherapy; Drugs; Mammary Glands

20040086237 Naval Postgraduate School, Monterey, CA
Influences on the Retention of Residency-Trained and Non-Residency Trained Navy Dental Corps Officers
Christian, Alan B.; Jun. 2004; 75 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424670; No Copyright; Avail: CASI; A04, Hardcopy

This research project identifies key influences on the retention of Navy Dental Officers beyond their post- obligation period. Two sample groups were selected. The first sample group was selected from Dental Officers who did not receive a Navy sponsored residency program and the second group from Dental Officers who completed a Navy sponsored residency program. Logistic regression models were developed for the Non-Residency and Residency sample data obtained from Bureau of Medicine and Surgery Manpower Information System. The results revealed that accession source, dental specialty and the number of operational tours as a percentage of total tours an officer completes during his or her obligation period were significant factors for retention of Dental Officers in the Non-Residency Model. Significant factors identified for the Residency Model were gender, age when first paid as a Navy Dentist, the number of years Dental Officers waited to begin a Navy-sponsored residency program and dental specialty. Dental Officers who receive their residency training between their sixth and eight year of service are more likely to remain on active duty more than one year beyond their obligated service commitment than officers beginning residency programs earlier or later in their careers.
DTIC
Dentistry; Military Personnel; Navy; Personnel Management

20040086239 Chicago Association for Research and Education in Science, Hines, IL
Molecular Mechanisms of Schwann Cell Proliferation in NF1
DeVries, George H.; Sep. 2002; 143 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-98-1-8607
Report No.(s): AD-A424674; No Copyright; Avail: CASI; A07, Hardcopy

Neurofibromatosis type 1 (NFl) is a genetic disorder characterized by tumors comprised principally of Schwann cells lacking the neurofibromin gene. Our studies concentrated on the metabolic changes that occur in Schwann cells derived from NFl tumors. We documented the following changes: aberrant expression of cell surface receptors, including c-Kit and pDGF, novel pathways stimulated by activation of these receptors leading to the prevention of apoptosis and increased calcium levels, abnormal secretion of prostaglandin, and subsequent activation of prostaglandin receptors, increased expression of prostaglandin receptors, and elevated cAMP. Developmental studies of c-Kit revealed the role for this cell surface receptor during development in preventing apoptosis. The overexpression of these receptors and subsequent changes in intracellular metabolism all contribute to the enhancement of the proliferative potential of Schwann cells, allowing increased tumor growth. These altered metabolic pathways provide new therapeutic targets for controlling the growth of Schwann cells in tumors in neurofibromatosis type 1.
DTIC
Cancer; Cells (Biology); Diseases; Fibrosis; Genetics; Regeneration (Physiology)

20040086242 Boston Univ., Boston, MA
The Nigrostriatal Dopamine System and Methamphetamine: Roles for Excitotoxicity and Environment, Metabolic, and Oxidative Stress
Yamamoto, Bryan; Jul. 2003; 83 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-99-1-9479
Report No.(s): AD-A424679; No Copyright; Avail: CASI; A05, Hardcopy

Degeneration of the nigrostriatal dopamine system is linked to the pathophysiology of Parkinson’s disease. Similarly, the psychostimulant drug, methamphetaminealso produces relatively selective damage to nigrostriatal dopamine neurons and is a widespread problem and drug of abuse throughout the U. S. However, the neurochemical underpinnings that mediate methamphetamine toxicity and Parkinson’s disease are unknown. Several variables common to methamphetamine toxicity and Parkinson’s disease, each of which may be important but alone are insufficient, may account for the neurodegeneration of the nigrostriatal dopamine path. It is hypothesized that the convergence of excitotoxicity, free radicals and a depleted bioenergetic state produces damage to dopamine neurons. Moreover, environmental stressors, which also increase free radicals and excitatory amino acids predispose dopamine neurons to damage. Consequently, environmental stress may be synergistic with oxidative and metabolic insults as well as glutamate to culminate in dopamine cell death. The major objective is to examine the interaction between environmental stress and methamphetamine and the convergent action of excitotoxicity and bioenergetic and oxidative stress to produce damage to nigrostriatal dopamine neurons. A multidisciplinary approach will be used as well as pharmacological strategies that we posit to be neuroprotective against methamphetamine, excitotoxicity, and bioenergetic and oxidative stress will be examined.
DTIC
Amphetamines; Diseases; Dopamine; Metabolism; Nervous System

20040086243 George Washington Univ., Washington, DC
The Establishment of an Inflammatory Breast Cancer Registry and Biospecimen Repository
Levine, Paul H.; Aug. 2003; 66 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0244
Report No.(s): AD-A424681; No Copyright; Avail: CASI; A04, Hardcopy

The Inflammatory Breast Cancer Registry (IBCR) enrolled its first patient Sept. 10, 2002, after completing all necessary IRB and HIPAA pre-study requirements. As of Nov. 1, 2003, 120 patients have asked to be enrolled in the IBCR and 110 have completed their interviews. Tissue blocks have been obtained from 51 patients and frozen surgical specimens have been collected from 10. A biospecimen Advisory Board was established and procedures are now in place to send biospecimens to requesting laboratories on a pilot basis and determine the number of subsequent specimens sent based on the initial results. Five laboratories are currently collaborating with multiple assays being performed by three of them. The lessons learned from the first 50 patients are being presented at the San Antonio Breast Cancer Conference in December 2003. The data include the observation that approximately one third of IBC patients are initially diagnosed as having mastitis and are treated with up to five months of antibiotics before the diagnosis of cancer is made. Less than 25% of patients have a discrete mass identified on initial mammography. Most patients received standard IBC therapy (chemotherapy followed by mastectomy, additional chemotherapy and radiation) but some were not offered surgery.
DTIC
Cancer; Chemotherapy; Mammary Glands

20040086251 Texas A&M Univ., College Station, TX

Designing Lithographically Patterned Phospholipid Bilayer Arrays for Next-Generation Biosensors and Immunoassays

Cremer, Paul S.; Jun. 14, 2004; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-01-1-0346

Report No.(s): AD-A424699; ARO-41611.14-LS; No Copyright; Avail: CASI; A02, Hardcopy

We have met approximately 90% of the goals outlined in our original grant application. Fifteen papers were published acknowledging ARO funding. The work accomplished involves the exploitation of temperature, concentration, pH, and ionic strength gradients on-chip for use in heterogeneous immunoassays for ligand-receptor binding at biomembrane surfaces. The platforms we have built allow for high throughput measurements, while requiring only microliters of solution in order to obtain binding information. The signal- to-noise ratio is higher than conventional assays because time dependent sources of noise have largely been eliminated. We have studied IgG binding to fluid membranes as a function of both hapten density and cholesterol content in the membrane. The results suggest that we can now understand the basic principles for multiple binding of analytes (proteins, toxins, viruses, etc...) at a membrane interface. In addition, we expanded our lab-on-a-chip platforms for use with whole cells in chemotaxis as well as in the employment of elastomeric proteins and polymers for temperature gradient assays.

DTIC

Antibodies; Bioinstrumentation; Globulins; Immunoassay; Ligands; Lipids; Membranes; Receptors (Physiology)

20040086256 Toronto Univ., Ontario

Regulation of the Mevalonate Pathway for the Prevention of Breast Cancer

Archer, Michael C.; Aug. 2003; 42 pp.; In English

Contract(s)/Grant(s): DAMD17-99-1-9409

Report No.(s): AD-A424707; No Copyright; Avail: CASI; A03, Hardcopy

HMG-CoA reductase is the rate-limiting enzyme in cholesterol biosynthesis that catalyzes the production of mevalonate. In addition to being a precursor of cholesterol, mevalonate is required by cells for DNA synthesis and cell cycle progression. We have investigated the hypothesis that the mevalonate pathway may be a useful target for cancer prevention and therapy. We have shown that the dietary fatty acids docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA) as well as the dietary isoprenoid geraniol that inhibit cell proliferation, are inhibitors of HMG-CoA reductase activity in breast cancer cells. The inhibitory effects of EPA and geraniol on cell proliferation, however, are independent of mevalonate. DHA, on the other hand, inhibits proliferation at least in part, by inhibiting mevalonate synthesis. We showed that exogenous mevalonate promotes growth of breast cancer cells in nude mice as well as proliferation of the cells in culture. This was associated with an increase in the passage of cells through the G1 restriction point of the cell cycle. Mevalonate caused increased cyclin A- and E-associated CDK2 activity. This was mediated by increased phosphorylation of CDK2 and decreased binding of CDK2 to the CDK1 p21(sup cipl). These findings may be important since common treatments to lower serum cholesterol increase mevalonate synthesis.

DTIC

Blood; Cancer; Cholesterol; Health; Mammary Glands; Prevention; Serums

20040086257 North Carolina State Univ., Raleigh, NC

Increasing Follow-Up Rates Among African American Women With Abnormal Mammography Results

Holden, Debra J.; Dec. 2003; 90 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0580

Report No.(s): AD-A424710; No Copyright; Avail: CASI; A05, Hardcopy

The proportion of mammograms interpreted as abnormal in large screening programs is as high as 15-20%. Thus, if 15% of the 48 million American women 40 years of age or older have mammograms, there would be more than 7 million abnormal mammography results each year. It has been estimated that 30% or more of women with abnormal mammograms fail to comply with follow-up recommendations. This proportion is disparate across racial groups, - such that women from minority populations are less likely to receive follow-up than white women. There is little known about why this disparity exists and a need to find out more in order to decrease the number of black women dying from this disease. This study proposed to look at this existing problem from a new perspective-that of the African American woman. The goal of this study was to improve the rates of follow-up in African American women after an abnormal mammogram result by understanding the variables that predict follow-up and developing an innovative intervention through community input that overcomes obstacles to follow-up. Thirty-nine women were interviewed about their health practices, particularly their knowledge, attitudes, and practices

associated with mammogram screening. Findings indicate that mot of the women are receiving regular care and are fairly positive about the importance of early detection.
DTIC
Abnormalities; Africa; Cancer; Females; Mammary Glands

20040086259 New Jersey Medical School, Newark, NJ
A Novel Strategy to Isolate Invasion-Inducing Proteins From Human Breast Tumors
Whitehead, Ian P.; Jun. 2003; 19 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0365
Report No.(s): AD-A424712; No Copyright; Avail: CASI; A03, Hardcopy

Retroviral-based expression libraries have been developed from breast tumor cells, and then screened for cDNAs whose expression confers an invasive phenotype on non-invasive breast tumor cells. Four independent cDNAs have been recovered and restested in these- screens (DAP-l, LIPE, HSPA5, ABLIM). The Dap-l cDNA was orientated in the antisense and is by far the most invasive of the four. When tested in other cell types, only the Dap-l cDNA exhibited transforming properties. Since Dap-l has been attributed tumor suppressor properties in other biological systems, it was selected for a more detailed analysis. Anti-sense expression of DAP-l was associated with activation of the small GTPase RhoA in NIH 3T3 cells, but-downregulation of RhoA in MCF-7 cells. No effects were noted for Raci or Cdc42, or when DAP-l was expressed in the sense orientation. Analysis of the actin cytoskeleton of MCF-7 cells in which DAP-l is suppressed revealed a phenotype that is consistent with loss of RhoA function, and the motile phenotype could be suppressed by expression of activated RhoA. To summarize, we have identified DAP-l as a tumor suppressor in breast cancer cells that can regulate motility and invasion through regulation of the small GTPase RhoA.
DTIC
Cancer; Cells (Biology); Mammary Glands; Muscles; Proteins; Tumors

20040086261 North Carolina Univ., Chapel Hill, NC
Developing Strategies to Block Beta-Catenin Action in Signaling and Cell Adhesion During Carcinogenesis
Peifer, Mark A.; Jul. 2003; 53 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-98-1-8223
Report No.(s): AD-A424714; No Copyright; Avail: CASI; A04, Hardcopy

To understand cancer, we must first understand normal cell behavior. Drosophila Armadillo (Arm) and its human homolog Beta-catenin are key players in adhesive junctions and in transduction of Wingless (Wg)/Wnt signals. Our working hypotheses are: 1) Several protein partners compete to bind Arm, and 2) Arm:dTCF activates Wg-responsive genes, while dTCF alone represses the same genes. Aim I is to understand how different partners compete with one another for binding Arm. Aim 2 focuses on how Arm and dTCF positively and negatively regulate Wg-responsive genes. In our Final Report last year, we reported significant progress on both Aims. Here we describe additional work we have accomplished during a final one-year no cost-extension. In this period, we have examined interaction of Wnt and JNK pathways and the role of the MAPK phosphates Puckered in this interaction.
DTIC
Adhesion; Cancer; Carcinogens; Cells (Biology); Mammary Glands

20040086267 Georgetown Univ. Hospital, Washington, DC
Prevention of Prostate Cancer by Inositol Hexaphosphate
Banerjee, Partha P.; Feb. 2004; 6 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0080
Report No.(s): AD-A424731; No Copyright; Avail: CASI; A02, Hardcopy

Prostate cancer (PCa) is the most common invasive malignancy and second leading cause of cancer death in men in the USA. Up until now, hormone ablation therapy is the major way to treat PCa. Such therapy only causes a temporary regression and tumor growth resumes within 6-18 months. Therefore, better androgen blockade is not the answer for treating PCa. Rather, research efforts should focus on the therapeutic agents that will inhibit growth factor signaling pathways thereby inhibit growth. A large number of studies have pointed out that inositol hexaphosphate (IP6) could have beneficial effect on variety of cancers. The specific aims of this proposal are to determine (1) the in vivo effects of IP6 on the growth of PCa (2) the efficacy of IP6 in inhibiting growth factor-induced DNA synthesis of the PCa cells in vitro, and (3) the molecular mechanisms by which IP6 inhibit growth of PCa cells. The information we obtain from these experiments will provide a better

understanding of the potential role of IP6 in the prevention of growth of PCa cells. This information will lead to more effective PCa prevention and treatment strategies in humans that might prolong the longevity of men with prostate cancer.
DTIC
Cancer; Health; Inositols; Prevention; Prostate Gland

20040086285 Kentucky Univ., Lexington, KY
Using a 0-10 Scale for Assessment of Anxiety in Patients with Acute Myocardial Infarction
De Jong, Marla J.; An, Kyungeh; McKinley, Sharon; Garvin, Bonnie J.; Hall, Lynne A.; Jan. 2003; 25 pp.; In English
Report No.(s): AD-A424770; AFIT-CI-04-417; No Copyright; Avail: CASI; A03, Hardcopy

Patients with acute myocardial infarction (AMI) often experience anxiety, an emotion that predicts adverse physiologic outcomes. Critical care clinicians have not adopted an anxiety assessment instrument for widespread use, due in part to the unavailability of an easy-to-administer anxiety instrument that is not burdensome to either clinicians or critically ill patients. To determine whether a single-item anxiety assessment instrument, the Anxiety Level Index (ALI), is a valid alternative to the State Anxiety Inventory (SAI) or the anxiety subscale of the Brief Symptom Inventory (BSI) in assessing state anxiety for patients with AMI. In this prospective multi-center study, 243 inpatients with AMI rated their anxiety using the SAI, the anxiety subscale of the BSI, and the ALI. Anxiety Level Index scores were compared to SAI and BSI anxiety subscale scores using Spearman's rho test and the Bland-Altman method.
DTIC
Anxiety; Myocardial Infarction; Patients

20040086286 California Univ., Los Angeles, CA
Advanced Developments of Electron Spin Labeling as High-Resolution Sensors of Protein Structure and Conformational Switching
Hubbell, Wayne L.; Nov. 13, 2003; 5 pp.; In English
Contract(s)/Grant(s): DAAD19-01-0522
Report No.(s): AD-A424773; ARO-42652.1-MS; No Copyright; Avail: CASI; A01, Hardcopy

The dynamic modes of a nitroxide side chain in a protein directly reflect both the local 3D structure and dynamics of the protein. If the structural and dynamical contributions can be resolved, a map of side chain mobility throughout a protein molecule can provide an image of protein structure and dynamic features related to function. To separate these contributions, libraries of spin-labeled mutants of T4 lysozyme (T4L), Myoglobin (Myb) and Cellular Retinol Binding Protein (CRBP) were prepared, and the corresponding EPR spectra analyzed by simulation techniques. In addition, x-ray structures were determined for select spin- labeled T4 mutants. The collective results of these efforts have provided an unprecedented level of sophistication in interpretation of the EPR spectra of labeled proteins, and establish the feasibility of separating structural and dynamical contributions. In addition, a 'bridge project' to the DARPA MOSAIC project has been completed. In this venture, spin labeled Annexin XII and T4L were supported on planar surfaces and oriented in the external magnetic field of the EPR spectrometer. Such specimens provide an additional dimension (orientation) to extract structural information, and provide the basis for producing suitable specimens for the single spin microscope under construction at UCLA.
DTIC
Crystal Structure; Electron Paramagnetic Resonance; Electron Spin; High Resolution; Molecular Dynamics; Nitrogen Oxides; Proteins; Switching

20040086588 Princeton Univ., NJ, USA
Colloids, Candies, DNA: Packing, Pushing, and Pasting
Chaikin, Paul; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 3; In English; See also 20040086587; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

With an aim toward colloidal architecture of dynamic microstructures, we have fabricated nonspherical colloids, modeled their packing properties with M&M's, manipulated them with AC electric fields and laser tweezers and reversibly stuck them together with DNA.
Author
Colloids; Deoxyribonucleic Acid; Fabrication; Microstructure

20040086593 European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands
ESA Research Announcement of Opportunity in Life and Physical Sciences
Molster, Frank; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 109; In English; See also 20040086587; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

ESA will announce a new research opportunity in the areas of Life and Physical Sciences. In the area of physical Sciences, Research projects for the full range of Physical Sciences with relation to the absence of gravity are invited for submission. The deadline for submission will be the 30-th of September 2004. More information can be found at http://www.spaceflight.esa.int/users/file.cfm?filename=coord-ao-lra
Author
European Space Agency; Life Sciences; Physical Sciences

20040086609 Konstanz Univ., Germany
Diffusing-Wave Spectroscopy as a Probe for Neuronal Activity
Li, J.; Dietsche, G.; Iftime, D.; Skipetrov, S. E.; Rockstroh, B.; Maret, G.; Elbert, T.; Gisler, T.; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 63-65; In English; See also 20040086587; No Copyright; Avail: CASI; A01, Hardcopy

In contrast to photon-migration imaging which is playing an increasingly important role as an imaging technique for neurophysiology, experiments using diffusing-wave spectroscopy (DWS) for brain imaging have been scarce: aiming at mapping blood flow velocities in cortical vessels, Lohwasser et al. have tried to account for the effects of multiple light scattering in laser Doppler spectra from brain phantoms. Using a CCD camera, Dunn er al. mapped the cerebral blood flow with spatially resolved measurements of the speckle contrast from an exposed rat cortex. A recent experiment by Cheung et al. on a semiexposed mouse brain revealed that the field autocorrelation function shown a faster decay with a complex shape upon stimulation by increased CO2 partial pressure. This suggests that using DWS to investigate functional brain activity in an entirely non-invasive way is likely to be complicated by the heterogenous optical and dynamical properties of the head consisting of scalp, skull, cerebrospinal fluid and white and gray matter. The scattering of light from subcellular organelles in cortical tissue should give rise to speckle fluctuations that are largely unrelated to blood flow. From isolated neural tissue it is known that neurosecretory release enhances the mobility of neurosynaptic vesicles, which might be detectable by DWS form cortical tissue entirely non-invasively. In this contribution we present results of near-infrared DWS measuremnts on a group of volunteers to detect functional activation of the human motor cortex through intact scalp and skull.
Derived from text
Neurophysiology; Diffusion Waves; Spectroscopy; Imaging Techniques; Efferent Nervous Systems

52
AEROSPACE MEDICINE

Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments, see *53 Behavioral Sciences*. For the effects of space on animals and plants see *51 Life Sciences*.

20040086153 Defence Research and Development Canada, Toronto, Ontario
G-Tolerance in Acute Repetitive Acceleration Conditions Relevant to Air Combat Maneuvering
Buick, Fred; Lalande, Sophie; Urquhart, Nathan A.; Sep. 2003; 5 pp.; In English
Contract(s)/Grant(s): N00014-01-1-0044
Report No.(s): AD-A424490; No Copyright; Avail: CASI; A01, Hardcopy

Air combat maneuvering produces frequent, repetitive excursions to headward acceleration (+Gz) but little is known about physiologic tolerance to successive Gz exposures. Human responses to simulated air combat maneuvering (SACM) were measured with SACM comprised of 10 repetitive cycles of moderate +Gz loads in two investigations, on a human centrifuge (N=13), and an electronic tilt-table (N=15), respectively. Physiologic responses (blood pressure, visual field, head-level blood content) were significantly improved in cycles 2-10 compared to cycle 1 indicating +Gz tolerance increased approximately 0.4 Gz (range 0.3 - 0.6 Gz depending on SACM type and test facility). The gains are attributed to enhanced vascular resistance. Therefore, a pilot's physiologic tolerance is not expected to decrease due to repetitive +Gz during aerial combat engagement. Anti-G straining maneuvers were not studied and could produce secondary effects in such environments.
DTIC
Acceleration Tolerance; Combat; Maneuvers; Warfare

20040086171 Naval Postgraduate School, Monterey, CA
An Analysis of ANAM Readiness Evaluation System (ARES) as a Predictor of Performance Degradation Induced by Sleep Deprivation in Officer Indoctrination School (OIS) Students
Younkers, Shonee L.; Jun. 2004; 75 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424535; No Copyright; Avail: CASI; A04, Hardcopy

Modeling fatigue, sleepiness, and performance is of significant interest to military leaders because military operations often provide limited sleep opportunities for many individuals. The ANAM Readiness Evaluation System (ARES) Commander Eattery is under consideration as a quick, inexpensive method of testing a crewmember's level of functioning. This thesis analyzed data collected during a previous field fatigue study conducted at the Naval Officer Indoctrination School (QIS) in Newport, Rhode Island. Linear mixed-effects models were developed and ARES data were evaluated for how they vary across participants, testing sessions, and time of day.
DTIC
Degradation; Human Performance; Personnel; Schools; Sleep Deprivation; Students

20040086196 Wisconsin Univ., Madison, WI
The Adaptive Response to Intestinal Oxidative Stress in Mammalian Hibernation
Carey, Hannah V.; Oct. 24, 2003; 13 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-01-1-0455
Report No.(s): AD-A424599; DUNNS-16120122; ARO-42419.1-LS; No Copyright; Avail: CASI; A03, Hardcopy

The goal of this project is demonstrate how mammalian hibernators utilize the physiologic consequences of metabolic depression, which include changes in mitochondrial function, low body temperatures (T sub b) and reduced blood flow, to activate cellular signaling pathways that minimize oxidative damage to sensitive tissues during torpor-arousal cycles. Specific Aim 1 examines oxidative stress to the gut of ground squirrels during the seasonal cycle. (a) accumulation of oxidized lipids in the intestine (in progress); (b) seasonal changes in the intestinal glutathione redox system (completed); (c) seasonal changes in intestinal antioxidant enzymes (in progress). Specific Aim 2 examines consequences of intestinal oxidative stress during hibernation. a) seasonal changes in NF-Kappa(B) activation in intestine and the identity of activated cells (completed); b) seasonal changes in the intestinal mucosal immune system (in progress); c) the effect of hibernation on enterocyte apoptosis and cell cycle regulators (in progress). Part c has already identified several pro-and anti-apototic pathways as well as cell cycle proteins that are activated in the gut during hibernation. We have also completed studies on protein ubiquitination and the response of the exocrine pancreas to hibernation. Other studies related to the main goal of the project are in progress, including development of an intestinal ischemia- reperfusion model to test the protective effects of the hibernation phenotype on this trauma-induced event. Our findings provide insight into the dynamic nature of the hibernating phenotype in terms of oxidative stress and development of antioxidant defenses during regulated hypothermia and hypometabolism, and contribute to our working model of 'natural preconditioning' in mammalian hibernators.
DTIC
Hibernation; Intestines; Mammals; Metabolism; Oxidation; Squirrels; Stress (Physiology)

20040086244 Naval Postgraduate School, Monterey, CA
The Effects of Reversing Sleep-Wake Cycles on Mood States, Sleep, and Fatigue on the Crew of the USS JOHN C. STENNIS
Sawyer, Tiffoney L.; Jun. 2004; 127 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424687; No Copyright; Avail: CASI; A07, Hardcopy

This study investigates the effects of reversing sleep-wake cycles on mood, sleep, and fatigue of the crewmembers and Air Wing 9 of the USS JOHN C. STENNIS (CVN- 74). It also reviews the research conducted in sleep deprivation, circadian rhythms, shiftwork, fatigue, and mood. The effects of reversing sleep-wake cycle on mood of the crewmembers were analyzed by assessing a repeated administration of the Profile of Mood States (POMS). Mood states were monitored at three time points associated with the current work schedule (night shift vs. day shift) of the crewmembers. The results showed that younger participants were angrier than older participants on night shiftwork. The results also indicated that there was a significant interaction between repeated measures of mood states and gender. In addition, female participants reported significantly higher mood scale scores than the male participants, and topside participants were getting significantly less sleep than belowdecks participants. Given these findings, this area of research warrants further exploration. There is a significant need to educate military personnel of the effects of sleep deprivation and shiftwork on their job performance and individual health and safety.
DTIC
Activity Cycles (Biology); Moods; Reversing; Sleep; Stress (Physiology); Wakefulness

20040086275 Naval Postgraduate School, Monterey, CA
Quantifying Sleep and Performance of West Point Cadets: A Baseline Study
Kenney, Aileen; Neverosky, Daniel T.; Jun. 2004; 105 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424747; No Copyright; Avail: CASI; A06, Hardcopy

This study reports the initial findings of a four- year longitudinal study undertaken to assess the total amount of sleep received by cadets at the USA Military Academy. Specifically, data on the Class of 2007 were collected and analyzed during the freshman year. Survey data were collected (n=1290) on sleep habits prior to the cadets reporting to the Academy. Actigraphy data were collected (n=80) during summer military training and during the Fall academic semester. Survey data were analyzed using two different methods to determine total amount of sleep prior to reporting to the Academy (x-average =8.5 hrs, s. d.=1.7 hrs; x-average =7.76 hrs, s.d.=1.46 hrs). Actigraphy data revealed that cadets received much less nighttime sleep (naps not included) during the Fall academic semester than they reported receiving in the 30 days before Cadet Basic Training (total: x- average =5.32 hrs, s.d.=35.3 mins; school nights: x-average =4. 86 hrs, s.d.= 37.4 mins; non-school nights: x-average =6.56 hrs, s.d.=64.4 mins). Using morningness-eveningness chronotypes, owls and non-owls differed significantly along the following dimensions: cadet attrition (z=2.66, p=0.0039) , fall term academic quality point average (t=3.92, p\h0.001), military program score (t=5.169, p\h0.001), and physical program score (t=3.295, p=0.001). Suggestions for additional analysis of existing and subsequent data are proposed.
DTIC
Sleep; Sleep Deprivation

20040086568 NASA Langley Research Center, Hampton, VA, USA
Optimized Shielding for Space Radiation Protection
Wilson, J. W.; Cucinotta, F. A.; Kim, M.-H. Y.; Schimmerling, W.; [2000]; 8 pp.; In English; 1st International Workshop on Space Radiation Research; No Copyright; Avail: CASI; A02, Hardcopy

Abstract. Future deep space mission and International Space Station exposures will be dominated by the high-charge and -energy (HZE) ions of the Galactic Cosmic Rays (GCR). A few mammalian systems have been extensively tested over a broad range of ion types and energies. For example, C3H10T1/2 cells, V79 cells, and Harderian gland tumors have been described by various track-structure dependent response models. The attenuation of GCR induced biological effects depends strongly on the biological endpoint, response model used, and material composition. Optimization of space shielding is then driven by the nature of the response model and the transmission characteristics of the given material.
Author
Biological Effects; Exposure; Galactic Cosmic Rays; Ions; Physiological Responses; Radiation Shielding

20040086889 California State Polytechnic Univ., Pomona, CA, USA, NASA Ames Research Center, Moffett Field, CA, USA
Ethnic Differences in Bending Stiffness of the Ulna and Tibia
Arnaud, S. B.; Liang, M. T. C.; Bassin, S.; Braun, W.; Dutto, D.; Plesums, K.; Huvnh, H. T.; Cooper, D.; Wong, N.; May 11, 2004; 2 pp.; In English; American Society for Bone and Mineral Research 26th Annual Meeting, 1-5 Oct. 2004, Seattle, WA, USA
Contract(s)/Grant(s): NASA-SAA2-401535; NIH-SO6-GM053933-06
Report No.(s): Rept-04-A-586-ASBMR; Copyright; Avail: CASI; A01, Hardcopy

There is considerable information about the variations in bone mass associated with different opportunity to compare a mechanical property of bone in young college women of Caucasian, Hispanic and Asian descent who gave informed consent to participate in an exercise study. The subjects were sedentary, in good health, eumenorrheic, non-smokers and had body mass indices (BMI) less than 30. Measurements acquired were body weight, kg, and height, cm, calcaneal and wrist bone density, g/square cm (PIXI, Lunar GE) and bending stiffness (EI, Nm(exp 2)) in the ulna and tibia. E1 was determined non-invasively with an instrument called the Mechanical Response Tissue Analyzer (MRTA) that delivers a vibratory stimulus to the center of the ulna or tibia and analyzes the response curve based on the equation E1 = k(sub b) L(exp 3)/48 where k, is lateral bending stiffness, L is the length of the bone, E is Young's modulus of elasticity and I, the bending moment of inertia. The error of the test (CV) based on measurements of an aluminum rod with a known E1 was 4.8%, of calcaneal BMD, 0.54%, and of wrist bone density, 3.45%.
Derived from text
Bones; Bending; Ethnic Factors; Females; Races (Anthropology); Stiffness; Tibia; Ulna

20040090476 Institute of Space Medico-Engineering, Beijing, China
Space Medicine and Medical Engineering, Volume 17, No. 3
Wei, Jin-He, Editor; Chen, Shan-Guang, Editor; Su, Shuang-Ning, Editor; Jiang, Shi-Zhong, Editor; Wang, Xian-Min, Editor; Liu, Xin-Min, Editor; Su, Hong-Yu, Editor; Bai, Jing, Editor; Sun, Xi-Qing, Editor; Ma, Ai-Jun, Editor, et al.; June 15, 2004; ISSN 1002-0837; 84 pp.; In English; In Chinese
Report No.(s): CN-11-2774/R; Copyright; Avail: Other Sources

The titles in this issue include: 1) Study on a Non-contact Life Parameter Detection System Using Millimeter Wave (In English); 2) Myocardial Ultrastructural Changes of Rats Following Different Levels of Acute + Gz Exposure; 3) Effects of High Frequency Vibration on Expression of Myosin Heavy Chain (MHC) in Intrafusal and Extrafusal Fibers in Soleus Muscles of Tail-suspended Rats; 4) A Study on Pathological Changes of Brain after High + Gx Exposure in Rhesus Monkey; 5) Effects of BMP-2 on the Gene Expression of Rat Osteosarcoma Cells under Simulated Weightlessness; 6) Ultrastructural Changes in Cerebral Cortex and Cerebellar Cortex of Rats under Simulated Weightlessness; 7) Effects of Centrifuge Training on mRNA Expression in Different Rat Tissues; 8) Effects of Naoyaojia on Structural Mechanical Properties of Femur in Rats; 9) Effects of Self-generated LBNP Training on Cardiovascular Function and Lower Body Negative Pressure (LBNP) Tolerance; 10) Development of a Ground-based Experimental Facility for Space Waste Material Processing with Microorganism; 11) Relationship between Surface Electromyographic Signal (sEMG) Changes and Subjective Assessment of Muscle Fatigue during Isometric Contractions; 12) Monitoring of Anesthesia Depth Based on Approximate Entropy of EEG; 13) A Novel System for Constructing Voxel-based Finite Element (FE) Models of Dental Implant and Jawbone; 14) Position Emissron Tomography (PET) Images Analysis Based on Wavelet Transform; 15) A Motor Unit Action Potential (MUAP) Onset Detection Method of EMG Signal Based on Non-extensive Entropy; 16) The Algorithm Based on Wavelet for Canceling Muscle Electricity and Wide Range Frequency of Power Line Hum in ECG; 17) An Interactive Volume Rendering Algorithm for Laser Scanning Confocal Microscope Data; 18) An EEG Compression Algorithm Based on Embedded Zerotree Wavelet (EZW).
CASI
Aerospace Medicine; Medical Equipment; Medical Electronics

53
BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

20040086699 NASA Langley Research Center, Hampton, VA, USA
Human Response to Simulated Low-Intensity Sonic Booms
Sullivan, Brenda M.; [2004]; 10 pp.; In English; Noise-Con 2004, 12-14 Jul. 2004, Baltimore, MD, USA
Contract(s)/Grant(s): 706-92-02-55; No Copyright; Avail: CASI; A02, Hardcopy

NASA's High Speed Research (HSR) program in the 1990s was intended to develop a technology base for a future High-Speed Civil Transport (HSCT). As part of this program, the NASA Langley Research Center sonic boom simulator (SBS) was built and used for a series of tests on subjective response to sonic booms. At the end of the HSR program, an HSCT was deemed impractical, but since then interest in supersonic flight has reawakened, this time focusing on a smaller aircraft suitable for a business jet. To respond to this interest, the Langley sonic boom simulator has been refurbished. The upgraded computer-controlled playback system is based on an SGI O2 computer, in place of the previous DEC MicroVAX. As the frequency response of the booth is not flat, an equalization filter is required. Because of the changes made during the renovation (new loudspeakers), the previous equalization filter no longer performed as well as before, so a new equalization filter has been designed. Booms to be presented in the booth are preprocessed using the filter. When the preprocessed signals are presented into the booth and measured with a microphone, the results are very similar to the intended shapes. Signals with short rise times and sharp 'corners' are observed to have a small amount of 'ringing' in the response. During the HSR program a considerable number of subjective tests were completed in the SBS. A summary of that research is given in Leatherwood et al. (Individual reports are available at http://techreports.larc.nasa.gov/ltrs/ltrs.html.) Topics of study included shaped sonic booms, asymmetrical booms, realistic (recorded) boom waveforms, indoor and outdoor booms shapes, among other factors. One conclusion of that research was that a loudness metric, like the Stevens Perceived Level (PL), predicted human reaction much more accurately than overpressure or unweighted sound pressure level. Structural vibration and rattle were not included in these studies.
Author
Human Reactions; Sonic Booms; Sound Pressure; Structural Vibration; Numerical Control

Includes human factors engineering, bionics, man-machine systems, life support, space suits and protective clothing. For related information see also *16 Space Transportation and Safety* and *52 Aerospace Medicine*.

20040086228 Naval Postgraduate School, Monterey, CA

The Effects of Fatigue on Position Determination and Cognitive Workload Using a Visual and 3-Dimensional Auditory Display

Brown, Eric L.; Jun. 2004; 101 pp.; In English; Original contains color illustrations

Report No.(s): AD-A424659; No Copyright; Avail: CASI; A06, Hardcopy

This study compares the effects of a visual and a 3-dimensional auditory display on primary and secondary task performance, mood, and mental workload at incremental levels of sleep deprivation. It is based on a study conducted by the Army Research Laboratory, Cognitive Science Branch, Aberdeen, Maryland, from 12 Marines performing land navigational tasks in two helmet-mounted display (HMD) modes; visual and 3- dimensional auditory, for a 48 hour period. The results indicate that performance under sleep deprivation is significantly impacted in both modalities; however, performance in the primary task was more degraded in the 3-D auditory modality. Additionally, Marines were more likely to experience degraded performance in the secondary task with increased sleep deprivation. The recommendations address the need to design HMDs that will not overburden sensory channels and the concern for military leaders to understand the additional demands imposed on solders in a HMD environment.

DTIC

Display Devices; Human Performance; Sleep Deprivation; Workloads (Psychophysiology)

20040086716 NASA Langley Research Center, Hampton, VA, USA

Departure Energies, Trip Times and Entry Speeds for Human Mars Missions

Munk, Michelle M.; [1999]; 11 pp.; In English

Report No.(s): AAS-99-103; No Copyright; Avail: CASI; A03, Hardcopy

The study examines how the mission design variables departure energy, entry speed, and trip time vary for round-trip conjunction-class Mars missions. These three parameters must be balanced in order to produce a mission that is acceptable in terms of mass, cost, and risk. For the analysis, a simple, massless-planet trajectory program was employed. The premise of this work is that if the trans-Mars and trans-Earth injection stages are designed for the most stringent opportunity in the energy cycle, then there is extra energy capability in the ‘easier’ opportunities which can be used to decrease the planetary entry speed, or shorten the trip time. Both of these effects are desirable for a human exploration program.

Author

Risk; Trajectories; Energy Consumption; Time Functions; Atmospheric Entry; Mars Missions

20040086943 NASA Langley Research Center, Hampton, VA, USA

Changes in Pilot Behavior with Predictive System Status Information

Trujillo, Anna C.; [1998]; 6 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

Research has shown a strong pilot preference for predictive information of aircraft system status in the flight deck. However, changes in pilot behavior associated with using this predictive information have not been ascertained. The study described here quantified these changes using three types of predictive information (none, whether a parameter was changing abnormally, and the time for a parameter to reach an alert range) and three initial time intervals until a parameter alert range was reached (ITIs) (1 minute, 5 minutes, and 15 minutes). With predictive information, subjects accomplished most of their tasks before an alert occurred. Subjects organized the time they did their tasks by locus-of-control with no predictive information and for the 1-minute ITI, and by aviatenavigate-communicate for the time for a parameter to reach an alert range and the 15-minute conditions. Overall, predictive information and the longer ITIs moved subjects to performing tasks before the alert actually occurred and had them more mission oriented as indicated by their tasks grouping of aviate-navigate-communicate.

Author

Aircraft Pilots; Human Behavior; Civil Aviation; Performance Prediction; Information Systems

20040087161 NASA Langley Research Center, Hampton, VA, USA

Accelerating Ground-Test Cycle Time: The Six-Minute Model Change and Other Visions for the 21st Century

Kegelman, Jerome T.; [1998]; 15 pp.; In English

Report No.(s): AIAA Paper 98-0142; Copyright; Avail: CASI; A03, Hardcopy

The advantage of managing organizations to minimize product development cycle time has been well established. This paper provides an overview of the wind tunnel testing cycle time reduction activities at Langley Research Center (LaRC) and gives the status of several improvements in the wind tunnel productivity and cost reductions that have resulted from these activities. Processes have been examined and optimized. Metric data from monitoring processes provides guidance for investments in advanced technologies. The most promising technologies under implementation today include the use of formally designed experiments, a diverse array of quick disconnect technology and the judicious use of advanced electronic and information technologies.
Author
Ground Tests; Product Development; Costs

20040087167 NASA Ames Research Center, Moffett Field, CA, USA
Systems Engineering Techniques for ALS Decision Making
Rodriquez, Luis F.; Drysdale, Alan E.; Jones, Harry; Levri, Julie A.; [2004]; 11 pp.; In English; 34rd International conference on Environmental Systems, 19-22 Jul. 2004, Colorado Springs, CO, USA
Contract(s)/Grant(s): 131-20-10; No Copyright; Avail: CASI; A03, Hardcopy

The Advanced Life Support (ALS) Metric is the predominant tool for predicting the cost of ALS systems. Metric goals for the ALS Program are daunting, requiring a threefold increase in the ALS Metric by 2010. Confounding the problem, the rate new ALS technologies reach the maturity required for consideration in the ALS Metric and the rate at which new configurations are developed is slow, limiting the search space and potentially giving the perspective of a ALS technology, the ALS Metric may remain elusive. This paper is a sequel to a paper published in the proceedings of the 2003 ICES conference entitled, 'Managing to the metric: an approach to optimizing life support costs.' The conclusions of that paper state that the largest contributors to the ALS Metric should be targeted by ALS researchers and management for maximum metric reductions. Certainly, these areas potentially offer large potential benefits to future ALS missions; however, the ALS Metric is not the only decision-making tool available to the community. To facilitate decision-making within the ALS community a combination of metrics should be utilized, such as the Equivalent System Mass (ESM)-based ALS metric, but also those available through techniques such as life cycle costing and faithful consideration of the sensitivity of the assumed models and data. Often a lack of data is cited as the reason why these techniques are not considered for utilization. An existing database development effort within the ALS community, known as OPIS, may provide the opportunity to collect the necessary information to enable the proposed systems analyses. A review of these additional analysis techniques is provided, focusing on the data necessary to enable these. The discussion is concluded by proposing how the data may be utilized by analysts in the future.
Author
Decision Making; Systems Engineering; Life Support Systems; Technology Utilization

55
EXOBIOLOGY

Includes astrobiology; planetary biology; and extraterrestrial life. For the biological effects of aerospace environments on humans see *52 Aerospace Medicine*; on animals and plants see *51 Life Sciences*. For psychological and behavioral effects of aerospace environments see *53 Behavioral Sciences*.

20040086772 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Category V Compliant Container for Mars Sample Return Missions
Dolgin, Benjamin; Sanok, Joseph; Sevilla, Donald; Bement, Laurence J.; [2000]; 6 pp.; In English
Report No.(s): SAE-001CES-131; Copyright; Avail: Other Sources

A novel containerization technique that satisfies Planetary Protection (PP) Category V requirements has been developed and demonstrated on the mock-up of the Mars Sample Return Container. The proposed approach uses explosive welding with a sacrificial layer and cut-through-the-seam techniques. The technology produces a container that is free from Martian contaminants on an atomic level. The containerization technique can be used on any celestial body that may support life. A major advantage of the proposed technology is the possibility of very fast (less than an hour) verification of both containment and cleanliness with typical metallurgical laboratory equipment. No separate biological verification is required. In addition to Category V requirements, the proposed container presents a surface that is clean from any, even nonviable organisms, and any

molecular fragments of biological origin that are unique to Mars or any other celestial body other than Earth.
Author
Mars Sample Return Missions; Planetary Protection; Materials Handling; Samplers; Sterilization

20040086887 Search for Extraterrestrial Intelligence Inst., Mountain View, CA, USA
Ice Radiation Chemistry as a Source of Potential False Biomarkers on the Surface of Europa
Bernstein, Max P.; Sandford, Scott A.; Allamandola, Louis J.; July 2004; 1 pp.; In English; Bioastronomy Meeting, Jul. 2004, Reykjavic, Iceland
Contract(s)/Grant(s): 344-30-21-01; No Copyright; Avail: Other Sources; Abstract Only

If we find evidence of Life elsewhere in the Solar System it will probably be in form of chemical biomarkers, quintessentially biological molecules that indicate the presence of micro-organisms. While molecules such as amino acids and nucleo-bases might seem to be biomarkers, and alkyl substituted aromatics have been invoked as such, they are not necessarily. These molecules are present in some meteorites and are expected to be present on the surface of other planets even in the absence of life. Understanding the range of non-biological organic molecules which could act as false biomarkers in space is a prerequisite for any reasonable search for true biomarkers on other worlds. Our experiments have shown that some organic molecules in meteorites that appear biological in nature are formed by energetic processing of extraterrestrial ices can account for amino acids, quinones and other functionalized aromatic compounds. In the past, such molecules have been proposed as biomarkers. For example, alkylated aromatics were invoked as biomarkers in the Alan Hills 84001 'Martian meteorite.' When simple organics arrive at the surface of a body like Europa, either from below or from space, how long do they survive and what do they make? How can we distinguish these from real biomarkers?
Author
Biomarkers; Europa; Ice; Radiation Chemistry

59
MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

Includes general topics and overviews related to mathematics and computer science. For specific topics in these areas see *categories 60 through 67*.

20040086640
Customized Sampling Plans: A Guide to Alternative Sampling Techniques for National Transit Database Reporting
Chu, X.; May 2004; 30 pp.; In English
Report No.(s): PB2004-106621; NCTR-527-05/BC137-46; No Copyright; Avail: CASI; A03, Hardcopy

For estimating the system total unlinked passenger trips and passenger miles of a fixed-route bus system for the National Transit Database (NTD), the FTA approved sampling plans may either over-sample or do not yield FTA's required confidence and precision levels for the specific conditions of a transit agency. This guide helps transit agencies avoid these problems by developing their own sampling plans for fixed-route bus services.
NTIS
Confidence Limits; Data Bases; Passengers

20040086642 Minnesota Univ., Minneapolis, MN, USA
Recognition of Human Activity in Metro Transit Spaces
Gasser, G.; Bird, N. D.; Papanikolopoulos, N. P.; Jul. 2004; 22 pp.; In English
Report No.(s): PB2004-106432; CTS-04-02; No Copyright; Avail: CASI; A03, Hardcopy

In this report, we introduce a vision-based system to monitor for suspicious human activities at a bus stop. The system currently examines behavior for drug dealing activities which is characterized by individuals loitering around the bus stop for a very long time with no intention of using the bus. To accomplish this goal, the system must measure how long individuals loiter around the bus stop. To facilitate this, the system must track individuals from the video feed, identify them, and keep a record of how long they spend at the bus stop. The system is broken into three distinct portions: background subtraction, object-tracking, and human recognition. The background subtraction and object tracking modules use off-the-shelf algorithms and are shown to work well following people as the walk around a bus stop. The human recognition module segments the image of an individual into three portions corresponding to head, torso and legs. Using the median color of each of these

regions, two people can be quickly compared to see if they are the same person.
NTIS
Activity (Biology); Human Reactions

20040086650 National Inst. of Standards and Technology, Gaithersburg, MD, USA
Studies of Plain-to-Rolled Fingerprint Matching Using the NIST Algorithmic Test Bed (ATB)
Wood, S. S.; Wilson, C. L.; Apr. 2004; In English
Report No.(s): PB2004-105821; NISTIR-7112; No Copyright; Avail: National Technical Information Service (NTIS)

NIST recently conducted a series of fingerprint matching studies using an experimental laboratory system called the Algorithmic Test Bed (ATB). NIST's specimen of the ATB, a system used to test the functional characteristics of the AFIS component of the FBI's Integrated Automated Fingerprint Identification System (IAFIS), includes a gallery of nearly 1.2M subjects; it provides broad control over its operating modes and set points. This report focuses on one aspect of those studies: the matching of plain to rolled (and plain to plain) fingerprint images.
NTIS
Algorithms; Systems Integration

60
COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware and data processing. For components see *33 Electronics and Electrical Engineering*. For computer vision see *63 Cybernetics, Artificial Intelligence and Robotics*.

20040086787 NASA Ames Research Center, Moffett Field, CA, USA
Design Tools for Reconfigurable Hardware in Orbit (RHinO)
French, Mathew; Graham, Paul; Wirthlin, Michael; Larchev, Gregory; Bellows, Peter; Schott, Brian; [2004]; 6 pp.; In English; 2004 Earth Science Technology Conference, 22-24 Jun. 2004, Palo Alto, CA, USA; No Copyright; Avail: CASI; A02, Hardcopy

The Reconfigurable Hardware in Orbit (RHinO) project is focused on creating a set of design tools that facilitate and automate design techniques for reconfigurable computing in space, using SRAM-based field-programmable-gate-array (FPGA) technology. These tools leverage an established FPGA design environment and focus primarily on space effects mitigation and power optimization. The project is creating software to automatically test and evaluate the single-event-upsets (SEUs) sensitivities of an FPGA design and insert mitigation techniques. Extensions into the tool suite will also allow evolvable algorithm techniques to reconfigure around single-event-latchup (SEL) events. In the power domain, tools are being created for dynamic power visualiization and optimization. Thus, this technology seeks to enable the use of Reconfigurable Hardware in Orbit, via an integrated design tool-suite aiming to reduce risk, cost, and design time of multimission reconfigurable space processors using SRAM-based FPGAs.
Author
Reconfigurable Hardware; Field-Programmable Gate Arrays; Software Development Tools; Computer Systems Design

20040087102 NASA Langley Research Center, Hampton, VA, USA
Force and Moment Approach for Achievable Dynamics Using Nonlinear Dynamic Inversion
Ostroff, Aaron J.; Bacon, Barton J.; [1999]; 12 pp.; In English; AIAA Guidance, Navigation and Control Conference, 9-11 Aug. 1999, Portland, OR, USA
Report No.(s): AIAA Paper 99-4001; Copyright; Avail: CASI; A03, Hardcopy

This paper describes a general form of nonlinear dynamic inversion control for use in a generic nonlinear simulation to evaluate candidate augmented aircraft dynamics. The implementation is specifically tailored to the task of quickly assessing an aircraft's control power requirements and defining the achievable dynamic set. The achievable set is evaluated while undergoing complex mission maneuvers, and perfect tracking will be accomplished when the desired dynamics are achievable. Variables are extracted directly from the simulation model each iteration, so robustness is not an issue. Included in this paper is a description of the implementation of the forces and moments from simulation variables, the calculation of control effectiveness coefficients, methods for implementing different types of aerodynamic and thrust vectoring controls, adjustments for control effector failures, and the allocation approach used. A few examples illustrate the perfect tracking results obtained.
Author
Aerodynamic Characteristics; Control Simulation; Control Surfaces; Dynamic Control

20040095338 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Discrete-Time Demodulator Architectures for Free-Space Broadband Optical Pulse-Position Modulation

Gray, A. A.; Lee, C.; Interplanetary Network Progress Report; August 15, 2004; Volume 42-158; 45 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this work is to develop discrete-time demodulator architectures for broadband optical pulse-position modulation (PPM) that are capable of processing Nyquist or near-Nyquist data rates. These architectures are motivated by the numerous advantages of realizing communications demodulators in digital very large scale integrated (VLSI) circuits. The architectures are developed within a framework that encompasses a large body of work in optical communications, synchronization, and multirate discrete-time signal processing and are constrained by the limitations of the state of the art in digital hardware. This work attempts to create a bridge between theoretical communication algorithms and analysis for deep-space optical PPM and modern digital VLSI. The primary focus of this work is on the synthesis of discrete-time processing architectures for accomplishing the most fundamental functions required in PPM demodulators, post-detection filtering, synchronization, and decision processing. The architectures derived are capable of closely approximating the theoretical performance of the continuous-time algorithms from which they are derived. The work concludes with an outline of the development path that leads to hardware.

Author

Algorithms; Demodulators; Large Scale Integration; Light Modulation; Pulse Position Modulation; Optical Communication; Architecture (Computers)

20040095342 NASA Langley Research Center, Hampton, VA, USA

CFD: A Castle in the Sand?

Kleb, Bil; Wood, Bill; August 20, 2004; 9 pp.; In English; 34th AIAA Fluid Dynamics Conference and Exhibit, 28 Jun. - 1 Jul. 2004, Portland, OR, USA

Contract(s)/Grant(s): 794-40-3a

Report No.(s): AIAA Paper 2004-2627; Copyright; Avail: CASI; A02, Hardcopy

The computational simulation community is not routinely publishing independently verifiable tests to accompany new models or algorithms. A survey reveals that only 22% of new models published are accompanied by tests suitable for independently verifying the new model. As the community develops larger codes with increased functionality, and hence increased complexity in terms of the number of building block components and their interactions, it becomes prohibitively expensive for each development group to derive the appropriate tests for each component. Therefore, the computational simulation community is building its collective castle on a very shaky foundation of components with unpublished and unrepeatable verification tests. The computational simulation community needs to begin publishing component level verification tests before the tide of complexity undermines its foundation.

Author

Surveys; Tides; Computer Components

61
COMPUTER PROGRAMMING AND SOFTWARE

Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.

20040086104 California Univ., San Diego, La Jolla, CA

Operating System Support for Virtual Machines With Quality-of-Service Provisions

Pasquale, Joseph; Jun. 21, 2004; 7 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0304

Report No.(s): AD-A424386; AFRL-SR-AR-TR-04-0325; No Copyright; Avail: CASI; A02, Hardcopy

We are investigating system software mechanisms that support remote execution of mobile code (e.g., agents), with the goal of producing a middleware system design and implementation that is realistically deployable in and integrated with the current Internet and web environment. Our - system allows the development of application software structures that promote higher performance, better reliability, and improved security. Our work is especially relevant for end-user client devices that are mobile and wireless, and that need to interact with servers via established Internet and Web protocols. This work is

especially applicable in the context of distributed systems with mobile agents, and supplements our previous AFOSR project on System Support for Mobile Agents.
DTIC
Command and Control

20040086118 Army Research Lab., Aberdeen Proving Ground, MD
A Programmer's Guide to the Bounding Overwatch Behavior Software
Fields, MaryAnne; Jun. 2004; 32 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424419; ARL-MR-589; No Copyright; Avail: CASI; A03, Hardcopy

This report is a programmer's guide to the software developed for the Bounding Movement behavior implemented on the ATRV-Jr platforms. The Bounding Movement algorithm is documented and a detailed example is provided for other researchers trying to develop computer programs for the iRobot platforms. An overview of the behavior algorithm details on the computer code developed to implement the algorithm, and a discussion of future research are also provided.
DTIC
Boundaries; Computer Programming; Computer Programs; Manuals

20040086129 Purdue Univ., West Lafayette, IN
Sensor Modeling and 3D Visualization
Bethel, James; Spann, Joseph; Mar. 16, 2004; 113 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD-19-01-1-0002
Report No.(s): AD-A424450; ARO-41876.1-EV; No Copyright; Avail: CASI; A06, Hardcopy

Two related, but independent investigations were carried out under this project. The first related to sensor (camera) modeling as needed for the photogrammetric exploitation of imagery for mapping and geopositioning purposes. This task was further subdivided into two subtasks. The first of these involved performing a geometric camera calibration for a set of 4 co-boresighted video cameras (called CAMIS) used by TEC (Topographic Engineering Center) for remote sensing and mapping purposes. This involved setting up a laboratory calibration facility, collecting system imagery in that facility, developing software and algorithms to align the fixtures in the facility, and developing software and algorithms to perform the camera calibration. The second subtask was to investigate the detection of errors in aerial triangulation, motivated by recurrent problems using the SOCET SET triangulation module for large blocks of images The approach here was to implement and test two algorithms for such error detection in a prototype MATLAB GUI (graphical user interface) Testing showed that both algorithms had merit for the error blunder detection problem. The second task in the project was the further development of Vesper for the Battlespace (VFB) product. The goals here were to develop and demonstrate advanced sensor data fusion, 2D and 3D visualization capabilities, combine the visualization environment with precise geo-registration, creating a single, end-to-end data visualization system. This system enhances time critical operations such as intelligence gathering, mission planning and rehearsal, and operational command and control. Specific modules within VFB include auto geo- registration of EO,SAR,IR,HSI, and SIG data, sensor model update, sensor projectors, object models (DTED, etc.), and interactive 2D/3D visualization.
DTIC
Calibrating

20040086148 Michigan Univ., Ann Arbor, MI
Development of a Formal Theory of Agent-Based Computing for System Evaluation and System-Design Guidance
Pollack, Martha E.; Jun. 2004; 124 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-2-0621; DARPA ORDER-K550; Proj-TASK
Report No.(s): AD-A424483; AFRL-IF-RS-TR-2004-129; No Copyright; Avail: CASI; A06, Hardcopy

This report summarizes the research done on the DARPA-sponsored project on the Development of a Formal Theory 0 Agent-Based Computing for System Evaluation and System- Design Guidance, as part of the TASK program. The work was performed between September 2000 and September 2003, at the Artificial Intelligence Laboratory in the Department of Electrical Engineering and Computer Science at the University of Michigan. During the course of the project, significant advances have been made in the area of commitment strategies for autonomous agents, to enable such agents to manage sets of plans with rich temporal constraints in dynamic, uncertain environments. Specifically, we developed a set of computationally efficient techniques for both determining the consistency of sets of actions in order to decide whether or not newly introduced actions are compatible with existing commitments, and for merging new% commitments into sets of existing

ones. We also developed strategies for modifying a set of commitments in response to a new, incompatible action. Finally, we applied these computational techniques to various applications of interest to the TASK effort, including e- commerce, a briefing agent", and autonomous unmanned vehicles.
DTIC
Artificial Intelligence; Computers; Systems Analysis; Systems Engineering

20040086174 Massachusetts Inst. of Tech., Cambridge, MA
Programming Technology for Molecular-Scale Computing
Abelson, Hal; Sussman, Gerald J.; Knight, Thomas F.; Nagpal, Radhika; May 2004; 9 pp.; In English
Contract(s)/Grant(s): N00014-02-1-0721
Report No.(s): AD-A424551; No Copyright; Avail: CASI; A02, Hardcopy

Progress in molecular electronics is beginning to yield the technology for creating structures that incorporate myriads of nanoscale computationally active units. These could be fabricated at almost no cost, provided (1) the individual units need not all work correctly; and (2) there is no need to manufacture precise geometrical arrangements of the units or precise interconnections among them. Programming such structures to perform useful computations is a significant challenge. The objective of the research proposed here is to create foundational programming technology for reliably obtaining coherent, prespecified behavior from vast numbers of unreliable information- processing units, irregularly arranged and interconnected in unknown and even time-varying ways. Our approach combines principles for controlling complexity, drawn from computer science, with techniques for robust design, inspired by biology.
DTIC
Computer Programming; Molecular Electronics

20040086190 Naval Postgraduate School, Monterey, CA
Secure Remote Network Administration and Power Management
Sullivan, Mark P.; Jun. 2004; 71 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424582; No Copyright; Avail: CASI; A04, Hardcopy

Remote Network Administration allows network administrators to manage their networks while being physically separated from the network equipment. Having the capability to manage wired and wireless networks securely, from remote locations, can substantially reduce operating expenses across the entire Department of Defense. A variety of methods for remotely managing networks is explored for both wired and wireless networks. Requirements for remote network administration are identified. Chief among them is security and the ability to remotely manage power. Several widely-used remote management utilities are examined. All fail to meet these two requirements. A new power control device is presented that can be managed securely and remotely.
DTIC
Internets

20040086211 Naval Research Lab., Washington, DC
Initial Assessment of Human Performance Using the Gaiter Interaction Technique to Control Locomotion in Fully Immersive Virtual Environments
Sibert, Linda E.; , James N; Page, Robert C.; Barron, Jeremy T.; McCune, Justin A.; Jun. 30, 2004; 23 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-03-WX-2-0228; Proj-005
Report No.(s): AD-A424639; NRL/FR/5510--04-10; 086; No Copyright; Avail: CASI; A03, Hardcopy

We conducted a first test of the Gaiter locomotion interaction technique to gather data to refine the interaction technique document system development and assess system effectiveness. The test showed that the fundamental gesture of stepping in place to walk through the virtual environment worked well. Problems with the side step and back step could be attributed to balance problems caused by the harness. Accurate stopping was more difficult because of the narrow field-of-view of the head-mounted display (HML). We want the interaction techniques we develop to allow a person to have close to the same ability to coordinate head, arm, and leg movements as in the real world. We use the Iterative Design Process, which includes periodic testing to direct redesign and reimplementation throughout the development process.
DTIC
Human Performance; Locomotion; Virtual Reality

20040086238 Naval Postgraduate School, Monterey, CA

Analysis of DDD and VDT Simulation Techniques to Determine Feasibility of Using VDT Simulation to Validate DDD Models

Constantin, Eugen; Papapanagiotou, Nikolaos; Singh, Sanjeev; Jun. 2004; 107 pp.; In English; Original contains color illustrations

Report No.(s): AD-A424673; No Copyright; Avail: CASI; A06, Hardcopy

The purpose of this MBA project was to determine whether and how VDT can emulate the results obtained from A2C2 Experiments. To do that, we have first focused on learning the basics of VDT and DDD simulation techniques and then on how the models used in DDD can be analyzed using VDT. To this end, we obtained experimental data from DDD Experiment 8 and created representative models in VDT to determine the similarities and differences. We also kept detailed records of our research to assist individuals in the future who may want to expand on our work. The project involved studying of DDD and VDT techniques, establishing building blocks in VDT, creating a best effort model for DDD Experiment 8 and studying the various outcomes. In this project we could not successfully replicate the complex DDD Experiment 8 scenarios within VDT. However, important conclusions were drawn that would go a long way towards helping future studies in this regard.

DTIC

Command and Control; Computerized Simulation; Simulation

20040086241 Naval Postgraduate School, Monterey, CA

Installation, Configuration and Operational Testing of a PKI Certificate Server and Its Supporting Services

Ambers, Vanessa P.; Kelly, Amanda M.; Jun. 2004; 182 pp.; In English; Original contains color illustrations

Report No.(s): AD-A424677; No Copyright; Avail: CASI; A09, Hardcopy

Public key infrastructure (PKI) was created to provide the basic services of confidentiality, authenticity, integrity and non-repudiation for sensitive information that may traverse public (un-trusted) networks. This thesis provides a brief description of the background and functional components of a PKI, and then ‘builds’ a PKI to be used for research at the Naval Postgraduate School (NPS). Deficiencies of this PKI with respect to DoD PKI policy are delineated. The thesis addresses details of software selection, installation, configuration and operation, using Netscape’s Certificate Management System as its Certificate Authority application of choice. The functionality of this PKI was validated by testing all major certificate life-cycle events (creation, archival, revocation, validation, etc.) All but two of these tests were successful key escrow and revocation checking and thus these two remaining to be addressed by further work to make the NPS PKI fully functional.

DTIC

Installing; Performance Tests; Security

20040086249 Naval Postgraduate School, Monterey, CA

ASW Fusion on a PC

Mann, Joelle J.; Jun. 2004; 68 pp.; In English; Original contains color illustrations

Report No.(s): AD-A424696; No Copyright; Avail: CASI; A04, Hardcopy

LosCon, the software program developed for the author’s thesis and tested at sea, is designed to help the ASW commander regain tactical control in a loss of submarine contact situation. Persistent detection and cueing in the battlespace depend on utilizing contact reports from a network of combatant platform and offboard sensors. LosCon, an extended Kalman filter-based program modeled after MTST (Maneuvering Target Statistical Tracker), can integrate the sensor network very efficiently. Kalman filtering is a method of recursively updating the position of an evading target and accuracy of that position using imperfect measurements. Lines of bearing to the contact with associated standard deviation bearing errors and positions with their standard deviation range errors are the measurements LosCon uses to generate an ellipse of the submarine’s likely position or AOU (Area Of Uncertainty). LosCon will also generate an expanded AOU for any future time, allowing commanders to correctly estimate the size of the search area. The effectiveness of the sea shield concept depends on the ability of organic forces to deny the enemy tactical control of the battlespace area. Incorporating the information generated by LosCon would assist ASW commanders in maintaining undersea superiority.

DTIC

Antisubmarine Warfare; Computer Programs

20040086270 Naval Postgraduate School, Monterey, CA

CyberCIEGE Scenario Illustrating Secrecy Issues Through Mandatory and Discretionary Access Control Policies in a Multi-Level Security Network

LaMore, Robert L.; Jun. 2004; 210 pp.; In English; Original contains color illustrations

Report No.(s): AD-A424734; No Copyright; Avail: CASI; A10, Hardcopy

User training in computer and network security is crucial to the survival of modern networks, yet the methods employed to train users often seem ineffective. One possible reason is that users are not fully engaged during these training sessions and thus they tend to forget the lessons being taught. The CyberCIEGE game introduces a new method of training in computer and network security. The player engages in a simulation-based network security game, that reflects real-world security principles. Each time the CyberCIEGE game runs, it loads a Scenario Definition File (SDF) written to teach specific security concepts. This thesis developed such a scenario definition file for the CyberCIEGE game. The educational purpose of the scenario is to illustrate secrecy issues in the context of mandatory and discretionary access control in a multilevel networked environment. The primary work of this thesis was to construct the scenario definition file such that playing the resulting game would achieve this educational purpose. This thesis also resulted in the construction of scenario definition files to test the CyberCIEGE game engine for expected results. These tests resulted in several recommendations for improvement in the game engine.
DTIC
Access Control; Education; Numerical Control; Policies; Security

20040086653 NASA Langley Research Center, Hampton, VA, USA
Creation of Anatomically Accurate Computer-Aided Design (CAD) Solid Models from Medical Images
Stewart, John E.; Graham, R. Scott; Samareh, Jamshid A.; Oberlander, Eric J.; Broaddus, William C.; [1999]; 1 pp.; In English; 1999 American Association of Neurological Surgeons Annual Meeting, 24-29 Apr. 1999, New Orleans, LA, USA; No Copyright; Avail: Other Sources; Abstract Only

Most surgical instrumentation and implants used in the world today are designed with sophisticated Computer-Aided Design (CAD)/Computer-Aided Manufacturing (CAM) software. This software automates the mechanical development of a product from its conceptual design through manufacturing. CAD software also provides a means of manipulating solid models prior to Finite Element Modeling (FEM). Few surgical products are designed in conjunction with accurate CAD models of human anatomy because of the difficulty with which these models are created. We have developed a novel technique that creates anatomically accurate, patient specific CAD solids from medical images in a matter of minutes.
Author
Anatomy; Computer Aided Design; Computer Aided Manufacturing; Finite Element Method; Software Engineering

20040086675 NASA Langley Research Center, Hampton, VA, USA
Computation of Sensitivity Derivatives of Navier-Stokes Equations using Complex Variables
Vatsa, Veer N.; [2004]; 17 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Accurate computation of sensitivity derivatives is becoming an important item in Computational Fluid Dynamics (CFD) because of recent emphasis on using nonlinear CFD methods in aerodynamic design, optimization, stability and control related problems. Several techniques are available to compute gradients or sensitivity derivatives of desired flow quantities or cost functions with respect to selected independent (design) variables. Perhaps the most common and oldest method is to use straightforward finite-differences for the evaluation of sensitivity derivatives. Although very simple, this method is prone to errors associated with choice of step sizes and can be cumbersome for geometric variables. The cost per design variable for computing sensitivity derivatives with central differencing is at least equal to the cost of three full analyses, but is usually much larger in practice due to difficulty in choosing step sizes. Another approach gaining popularity is the use of Automatic Differentiation software (such as ADIFOR) to process the source code, which in turn can be used to evaluate the sensitivity derivatives of preselected functions with respect to chosen design variables. In principle, this approach is also very straightforward and quite promising. The main drawback is the large memory requirement because memory use increases linearly with the number of design variables. ADIFOR software can also be cumber-some for large CFD codes and has not yet reached a full maturity level for production codes, especially in parallel computing environments.
Derived from text
Computational Fluid Dynamics; Sensitivity; Derivation; Navier-Stokes Equation; Finite Difference Theory

20040086678 NASA Langley Research Center, Hampton, VA, USA
Characterization of a Recoverable Flight Control Computer System
Malekpour, Mahyar; Torres, Wilfredo; [1999]; 6 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

The design and development of a Closed-Loop System to study and evaluate the performance of the Honeywell Recoverable Computer System (RCS) in electromagnetic environments (EME) is presented. The development of a Windows-based software package to handle the time-critical communication of data and commands between the RCS and

flight simulation code in real-time while meeting the stringent hard deadlines is also submitted. The performance results of the RCS and characteristics of its upset recovery scheme while exercising flight control laws under ideal conditions as well as in the presence of electromagnetic fields are also discussed.
Author
Control Systems Design; Applications Programs (Computers); Electromagnetic Fields; Flight Simulation; Airborne/Spaceborne Computers; Feedback Control; Computer Systems Performance

20040086792 NASA Langley Research Center, Hampton, VA, USA, National Inst. of Aerospace, Hampton, VA, USA
Termination Proofs for String Rewriting Systems via Inverse Match-Bounds
Butler, Ricky, Technical Monitor; Geser, Alfons; Hofbauer, Dieter; Waldmann, Johannes; January 07, 2004; 20 pp.; In English
Contract(s)/Grant(s): NCC1-02043; WU 23-786-10-10
Report No.(s): NASA/CR-2004-213032; NIA-2004-02; No Copyright; Avail: CASI; A03, Hardcopy

Annotating a letter by a number, one can record information about its history during a reduction. A string rewriting system is called match-bounded if there is a global upper bound to these numbers. In earlier papers we established match-boundedness as a strong sufficient criterion for both termination and preservation of regular languages. We show now that the string rewriting system whose inverse (left and right hand sides exchanged) is match-bounded, also have exceptional properties, but slightly different ones. Inverse match-bounded systems effectively preserve context-free languages; their sets of normalized strings and their sets of immortal strings are effectively regular. These sets of strings can be used to decide the normalization, the termination and the uniform termination problems of inverse match-bounded systems. We also show that the termination problem is decidable in linear time, and that a certain strong reachability problem is deciable, thus solving two open problems of McNaughton's.
Author
Criteria; Proving; Data Processing; Matching; Computer Programs

20040086850 NASA Langley Research Center, Hampton, VA, USA
Computational Investigation of Fluidic Counterflow Thrust Vectoring
Hunter, Craig A.; Deere, Karen A.; [1999]; 14 pp.; In English; 35th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 20-23 Jun. 1999, Los Angeles, CA, USA
Report No.(s): AIAA Paper 99-2669; Copyright; Avail: CASI; A03, Hardcopy

A computational study of fluidic counterflow thrust vectoring has been conducted. Two-dimensional numerical simulations were run using the computational fluid dynamics code PAB3D with two-equation turbulence closure and linear Reynolds stress modeling. For validation, computational results were compared to experimental data obtained at the NASA Langley Jet Exit Test Facility. In general, computational results were in good agreement with experimental performance data, indicating that efficient thrust vectoring can be obtained with low secondary flow requirements (less than 1% of the primary flow). An examination of the computational flowfield has revealed new details about the generation of a countercurrent shear layer, its relation to secondary suction, and its role in thrust vectoring. In addition to providing new information about the physics of counterflow thrust vectoring, this work appears to be the first documented attempt to simulate the counterflow thrust vectoring problem using computational fluid dynamics.
Author
Computational Fluid Dynamics; Counterflow; Fluidics; Test Facilities; Thrust Vector Control

20040086856 NASA Langley Research Center, Hampton, VA, USA
A High-Order Method Using Unstructured Grids for the Aeroacoustic Analysis of Realistic Aircraft Configurations
Atkins, Harold L.; Lockard, David P.; [1999]; 11 pp.; In English
Report No.(s): AIAA Paper 99-1945; Copyright; Avail: CASI; A03, Hardcopy

A method for the prediction of acoustic scatter from complex geometries is presented. The discontinuous Galerkin method provides a framework for the development of a high-order method using unstructured grids. The method's compact form contributes to its accuracy and efficiency, and makes the method well suited for distributed memory parallel computing platforms. Mesh refinement studies are presented to validate the expected convergence properties of the method, and to establish the absolute levels of a error one can expect at a given level of resolution. For a two-dimensional shear layer instability wave and for three-dimensional wave propagation, the method is demonstrated to be insensitive to mesh smoothness. Simulations of scatter from a two-dimensional slat configuration and a three-dimensional blended-wing-body

demonstrate the capability of the method to efficiently treat realistic geometries.
Author
Aeroacoustics; Distributed Memory; Aircraft Configurations

20040086963 NASA Langley Research Center, Hampton, VA, USA
Development of a Free-Flight Simulation Infrastructure
Miles, Eric S.; Wing, David J.; Davis, Paul C.; [1999]; 10 pp.; In English
Report No.(s): AIAA Paper 99-4193; Copyright; Avail: CASI; A02, Hardcopy

In anticipation of a projected rise in demand for air transportation, NASA and the FAA are researching new air-traffic-management (ATM) concepts that fall under the paradigm known broadly as ':free flight". This paper documents the software development and engineering efforts in progress by Seagull Technology, to develop a free-flight simulation (FFSIM) that is intended to help NASA researchers test mature-state concepts for free flight, otherwise referred to in this paper as distributed air / ground traffic management (DAG TM). Under development is a distributed, human-in-the-loop simulation tool that is comprehensive in its consideration of current and envisioned communication, navigation and surveillance (CNS) components, and will allow evaluation of critical air and ground traffic management technologies from an overall systems perspective. The FFSIM infrastructure is designed to incorporate all three major components of the ATM triad: aircraft flight decks, air traffic control (ATC), and (eventually) airline operational control (AOC) centers.
Author
Computer Programming; Air Traffic Control; Air Transportation; Management Planning; Telecommunication

20040087024 NASA Langley Research Center, Hampton, VA, USA
Maximized Gust Loads of a Closed-Loop, Nonlinear Aeroelastic System Using Nonlinear Systems Theory
Silva, Walter A.; [1999]; 12 pp.; In English; 40th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 12-15 Apr. 1999, Saint Louis, MO, USA
Report No.(s): AIAA Paper 99-1474; Copyright; Avail: CASI; A03, Hardcopy

The problem of computing the maximized gust load for a nonlinear, closed-loop aeroelastic aircraft is discusses. The Volterra theory of nonlinear systems is applied in order to define a linearized system that provides a bounds on the response of the nonlinear system of interest. The method is applied to a simplified model of an Airbus A310.
Author
Gust Loads; Aeroelasticity; Computation

20040087025 NASA Langley Research Center, Hampton, VA, USA
Multidisciplinary Design Optimization Techniques: Implications and Opportunities for Fluid Dynamics Research
Zang, Thomas A.; Green, Lawrence L.; [1999]; 21 pp.; In English; 30th AIAA Fluid Dynamics Conference, 28 Jun. - 1 Jul. 1999, Norfolk, VA, USA
Report No.(s): AIAA Paper 99-3798; Copyright; Avail: CASI; A03, Hardcopy

A challenge for the fluid dynamics community is to adapt to and exploit the trend towards greater multidisciplinary focus in research and technology. The past decade has witnessed substantial growth in the research field of Multidisciplinary Design Optimization (MDO). MDO is a methodology for the design of complex engineering systems and subsystems that coherently exploits the synergism of mutually interacting phenomena. As evidenced by the papers, which appear in the biannual AIAA/USAF/NASA/ISSMO Symposia on Multidisciplinary Analysis and Optimization, the MDO technical community focuses on vehicle and system design issues. This paper provides an overview of the MDO technology field from a fluid dynamics perspective, giving emphasis to suggestions of specific applications of recent MDO technologies that can enhance fluid dynamics research itself across the spectrum, from basic flow physics to full configuration aerodynamics.
Author
Design Analysis; Fluid Dynamics; Multidisciplinary Research; Multidisciplinary Design Optimization

20040087123 Research Inst. for Advanced Computer Science, Moffett Field, CA, USA
Automating Traceability for Generated Software Artifacts
Richardson, Julian; Green, Jeffrey; [2004]; 10 pp.; In English; 19th ICEE International Conference on Automated Software Engineering, 20-25 Sep. 2004, Linz, Austria; No Copyright; Avail: CASI; A02, Hardcopy

Program synthesis automatically derives programs from specifications of their behavior. One advantage of program synthesis, as opposed to manual coding, is that there is a direct link between the specification and the derived program. This

link is, however, not very fine-grained: it can be best characterized as Program is-derived- from Specification. When the generated program needs to be understood or modified, more $ne-grained linking is useful. In this paper, we present a novel technique for automatically deriving traceability relations between parts of a specification and parts of the synthesized program. The technique is very lightweight and works -- with varying degrees of success - for any process in which one artifact is automatically derived from another. We illustrate the generality of the technique by applying it to two kinds of automatic generation: synthesis of Kalman Filter programs from speci3cations using the Aut- oFilter program synthesis system, and generation of assembly language programs from C source code using the GCC C compilel: We evaluate the effectiveness of the technique in the latter application.
Author
Coding; Computer Programs

20040087131 Research Inst. for Advanced Computer Science, Moffett Field, CA, USA
A Multiagent Modeling Environment for Simulating Work Practice in Organizations
Sierhuis, Maarten; Clancey, William J.; vanHoof, Ron; [2004]; 28 pp.; In English
Contract(s)/Grant(s): NCC2-1006; No Copyright; Avail: CASI; A03, Hardcopy

In this paper we position Brahms as a tool for simulating organizational processes. Brahms is a modeling and simulation environment for analyzing human work practice, and for using such models to develop intelligent software agents to support the work practice in organizations. Brahms is the result of more than ten years of research at the Institute for Research on Learning (IRL), NYNEX Science & Technology (the former R&D institute of the Baby Bell telephone company in New York, now Verizon), and for the last six years at NASA Ames Research Center, in the Work Systems Design and Evaluation group, part of the Computational Sciences Division (Code IC). Brahms has been used on more than ten modeling and simulation research projects, and recently has been used as a distributed multiagent development environment for developing work practice support tools for human in-situ science exploration on planetary surfaces, in particular a human mission to Mars. Brahms was originally conceived of as a business process modeling and simulation tool that incorporates the social systems of work, by illuminating how formal process flow descriptions relate to people s actual located activities in the workplace. Our research started in the early nineties as a reaction to experiences with work process modeling and simulation . Although an effective tool for convincing management of the potential cost-savings of the newly designed work processes, the modeling and simulation environment was only able to describe work as a normative workflow. However, the social systems, uncovered in work practices studied by the design team played a significant role in how work actually got done-actual lived work. Multi-tasking, informal assistance and circumstantial work interactions could not easily be represented in a tool with a strict workflow modeling paradigm. In response, we began to develop a tool that would have the benefits of work process modeling and simulation, but be distinctively able to represent the relations of people, locations, systems, artifacts, communication and information content.
Author
Environment Models; Computer Programs; Planetary Surfaces; Information

20040090499 NASA Langley Research Center, Hampton, VA, USA
Bi-Level Integrated System Synthesis (BLISS)
Sobieszczanski-Sobieski, Jaroslaw; Agte, Jeremy S.; Sandusky, Robert R., Jr.; [1998]; 16 pp.; In English; 7th AIAA/USAF/NASA/ISSMO Symposium on ultidisciplinary Analysis and Optimization, 2-4 Sep. 1998, Saint Louis, MO, USA
Report No.(s): AIAA Paper 98-4916; Copyright; Avail: CASI; A03, Hardcopy

BLISS is a method for optimization of engineering systems by decomposition. It separates the system level optimization, having a relatively small number of design variables, from the potentially numerous sub-system optimizations that may each have a large number of local design variables. The subsystem optimizations are autonomous and may be conducted concurrently. Subsystem and system optimizations alternate, linked by sensitivity data, producing a design improvement in each iteration. Starting from a best guess initial design, the method improves that design in iterative cycles, each cycle comprised of two steps. In step one, the system level variables are frozen and the improvement is achieved by separate, concurrent, and autonomous optimizations in the local variable subdomains. In step two, further improvement is sought in the space of the system level variables. Optimum sensitivity data link the second step to the first. The method prototype was implemented using MATLAB and iSIGHT programming software and tested on a simplified, conceptual level supersonic business jet design, and a detailed design of an electronic device.
Author
Computer Programming; Systems Integration; Optimization; Iteration; Design Analysis

20040090501 NASA Langley Research Center, Hampton, VA, USA
Versatile Software Package For Near Real-Time Analysis of Experimental Data
Wieseman, Carol D.; Hoadley, Sherwood T.; [1998]; 12 pp.; In English; 20th AIAA Advanced Measurement and Ground Testing Technology Conference, 15-18 Jun. 1998, Albuquerque, NM, USA
Report No.(s): AIAA Paper 98-2722; Copyright; Avail: CASI; A03, Hardcopy

This paper provides an overview of a versatile software package developed for time- and frequency-domain analyses of experimental wind-tunnel data. This package, originally developed for analyzing data in the NASA Langley Transonic Dynamics Tunnel (TDT), is applicable for analyzing any time-domain data. A Matlab-based software package, TDT-analyzer, provides a compendium of commonly-required dynamic analysis functions in a user-friendly interactive and batch processing environment. TDT-analyzer has been used extensively to provide on-line near real-time and post-test examination and reduction of measured data acquired during wind tunnel tests of aeroelastically-scaled models of aircraft and rotorcraft as well as a flight test of the NASA High Alpha Research Vehicle (HARV) F-18. The package provides near real-time results in an informative and timely manner far exceeding prior methods of data reduction at the TDT.
Author
Real Time Operation; Wind Tunnel Tests; Software Engineering; Transonic Wind Tunnels; Data Processing

20040090602 NASA Langley Research Center, Hampton, VA, USA
Comparison of Response Surface and Kriging Models for Multidisciplinary Design Optimization
Simpson, Timothy W.; Korte, John J.; Mauery, Timothy M.; Mistree, Farrokh; [1998]; 11 pp.; In English
Contract(s)/Grant(s): NAS1-19480; NSF DMI-96-12327
Report No.(s): AIAA Paper 98-4755; Copyright; Avail: CASI; A03, Hardcopy

In this paper, we compare and contrast the use of second-order response surface models and kriging models for approximating non-random, deterministic computer analyses. After reviewing the response surface method for constructing polynomial approximations, kriging is presented as an alternative approximation method for the design and analysis of computer experiments. Both methods are applied to the multidisciplinary design of an aerospike nozzle which consists of a computational fluid dynamics model and a finite-element model. Error analysis of the response surface and kriging models is performed along with a graphical comparison of the approximations, and four optimization problems m formulated and solved using both sets of approximation models. The second-order response surface models and kriging models-using a constant underlying global model and a Gaussian correlation function-yield comparable results.
Author
Kriging; Design Analysis; Models; Multidisciplinary Design Optimization; Computational Fluid Dynamics

20040090604 NASA Langley Research Center, Hampton, VA, USA
Preliminary Results from the Application of Automated Adjoint Code Generation to CFL3D
Carle, Alan; Fagan, Mike; Green, Lawrence L.; [1998]; 11 pp.; In English
Contract(s)/Grant(s): NCC1-234; NSF CCR-91-20008
Report No.(s): AIAA Paper 98-4807; Copyright; Avail: CASI; A03, Hardcopy

This report describes preliminary results obtained using an automated adjoint code generator for Fortran to augment a widely-used computational fluid dynamics flow solver to compute derivatives. These preliminary results with this augmented code suggest that, even in its infancy, the automated adjoint code generator can accurately and efficiently deliver derivatives for use in transonic Euler-based aerodynamic shape optimization problems with hundreds to thousands of independent design variables.
Author
Computational Fluid Dynamics; Shape Optimization; Design Analysis

20040090607 NASA Langley Research Center, Hampton, VA, USA
Response Surface Model Building and Multidisciplinary Optimization Using D-Optimal Designs
Unal, Resit; Lepsch, Roger A.; McMillin, Mark L.; [1998]; 7 pp.; In English
Contract(s)/Grant(s): NAS1=19858-98
Report No.(s): AIAA Paper 98-4759; Copyright; Avail: CASI; A02, Hardcopy

This paper discusses response surface methods for approximation model building and multidisciplinary design optimization. The response surface methods discussed are central composite designs, Bayesian methods and D-optimal designs. An over-determined D-optimal design is applied to a configuration design and optimization study of a wing-body,

launch vehicle. Results suggest that over determined D-optimal designs may provide an efficient approach for approximation model building and for multidisciplinary design optimization.
Author
Multidisciplinary Design Optimization; Models; Body-Wing Configurations

20040090608 NASA Langley Research Center, Hampton, VA, USA
Optimization Issues with Complex Rotorcraft Comprehensive Analysis
Walsh, Joanne L.; Young, Katherine C.; Tarzanin, Frank J.; Hirsh, Joel E.; Young, Darrell K.; [1998]; 12 pp.; In English; 7th AIAA/USAF/NASA/ISSMO Symposium on Multidisciplinary Analysis and Optimization, 2-4 Sep. 1998, Saint Louis, MO, USA
Report No.(s): AIAA Paper 98-4889; Copyright; Avail: CASI; A03, Hardcopy

This paper investigates the use of the general purpose automatic differentiation (AD) tool called Automatic Differentiation of FORTRAN (ADIFOR) as a means of generating sensitivity derivatives for use in Boeing Helicopter's proprietary comprehensive rotor analysis code (VII). ADIFOR transforms an existing computer program into a new program that performs a sensitivity analysis in addition to the original analysis. In this study both the pros (exact derivatives, no step-size problems) and cons (more CPU, more memory) of ADIFOR are discussed. The size (based on the number of lines) of the VII code after ADIFOR processing increased by 70 percent and resulted in substantial computer memory requirements at execution. The ADIFOR derivatives took about 75 percent longer to compute than the finite-difference derivatives. However, the ADIFOR derivatives are exact and are not functions of step-size. The VII sensitivity derivatives generated by ADIFOR are compared with finite-difference derivatives. The ADIFOR and finite-difference derivatives are used in three optimization schemes to solve a low vibration rotor design problem.
Author
Computer Programs; Finite Difference Theory; Helicopters; Rotary Wing Aircraft

20040095295 Defence Science and Technology Organisation, Edinburgh, Australia
Performance Analysis and Optimisation of the Fact Extractor System
Heath, Shona; June 2004; 43 pp.; In English
Report No.(s): DSTO-TN-0566; AR-013-124; Copyright; Avail: Other Sources

DSTO has developed an in-house application called the Fact Extractor System for performing Information Extraction. This system can be used to extract interesting information from text documents. It is a component-based system providing a suite of tools to do this task. The system has a number of deployment tools, including one called FormFiller. FormFiller is an application that enables a user to process a set of documents, one at a time interactively or in an automated batch mode, with one or more Fact Extractors and save results to an output file under user control. This report describes performance testing and optimisation of the FormFiller application and Fact Extractors.
Author
Performance Tests; Optimization; Information Retrieval

20040095298 NASA Goddard Space Flight Center, Greenbelt, MD, USA
FEM and Multiphysics Applications at NASA/GSFC
Loughlin, James; [2004]; 15 pp.; In English; 2004 International ANSYS Conference, 24 May 2004, Greenbelt, MD, USA; No Copyright; Avail: CASI; A03, Hardcopy

FEM software available to the Mechanical Systems Analysis and Simulation Branch at Goddard Space Flight Center (GSFC) include: 1) MSC/Nastran; 2) Abaqus; 3) Ansys/Multiphysics; 4) COSMOS/M; 5) 'Home-grown' programs; 6) Pre/post processors such as Patran and FEMAP. This viewgraph presentation provides additional information on MSC/Nastran and Ansys/Multiphysics, and includes screen shots of analyzed equipment, including the Wilkinson Microwave Anistropy Probe, a micro-mirror, a MEMS tunable filter, and a micro-shutter array. The presentation also includes information on the verification of results.
CASI
Finite Element Method; Applications Programs (Computers); Computerized Simulation

20040095325 NASA Langley Research Center, Hampton, VA, USA
A Cooperative Human-Adaptive Traffic Simulation (CHATS)
Phillips, Charles T.; Ballin, Mark G.; [1999]; 12 pp.; In English
Contract(s)/Grant(s): NAS2-98005
Report No.(s): AIAA Paper 99-4231; Copyright; Avail: CASI; A03, Hardcopy

NASA is considering the development of a Cooperative Human-Adaptive Traffic Simulation (CHATS), to examine and evaluate performance of the National Airspace System (NAS) as the aviation community moves toward free flight. CHATS will be specifically oriented toward simulating strategic decision-making by airspace users and by the service provider s traffic management personnel, within the context of different airspace and rules assumptions. It will use human teams to represent these interests and make decisions, and will rely on computer modeling and simulation to calculate the impacts of these decisions. The simulation objectives will be to examine: 1. evolution of airspace users and the service provider s strategies, through adaptation to new operational environments; 2. air carriers competitive and cooperative behavior; 3. expected benefits to airspace users and the service provider as compared to the current NAS; 4. operational limitations of free flight concepts due to congestion and safety concerns. This paper describes an operational concept for CHATS, and presents a high-level functional design which would utilize a combination of existing and new models and simulation capabilities.
Author
Computerized Simulation; Decision Making; Free Flight; Traffic

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COMPUTER SYSTEMS

Includes computer networks and distributed processing systems. For information systems see *82 Documentation and Information Science*. For computer systems applied to specific applications, see the associated category.

20040086198 Air War Coll., Maxwell AFB, AL
Computer Network Defense: DOD and the National Response
Jenkins, James M.; Dec. 2, 2002; 49 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424603; No Copyright; Avail: CASI; A03, Hardcopy

This research paper examines the strategic framework for defense of the National Information Infrastructure (NII). Explored within the paper are the growing importance and dependency of the USA upon information technology and its associated infrastructure, possible threats to the information infrastructure, the implications of those threats, and currently employed defensive measures and their effectiveness. In addition, it provides five recommendations for improvements in the national strategic defensive posture: (1) establish a single agency for national information infrastructure defense, (2) establish a baseline regulatory environment, (3) employ core competencies of the DoD, (4) build bridges between Federal, state, and local governments, and (5) utilize DoD as national mentor.
DTIC
Computer Networks; Defense Program; Security

20040086200 Naval Postgraduate School, Monterey, CA
Advanced Techniques to Improve the Performance of OFDM Wireless LAN
Segkos, Michail; Jun. 2004; 135 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424608; No Copyright; Avail: CASI; A07, Hardcopy

OFDM systems have experienced increased attention in recent years and have found applications in a number of diverse areas including telephone-line based ADSL links, digital audio and video broadcasting systems, and wireless local area networks (WLAN). Orthogonal frequency-division multiplexing (OFDM) is a powerful technique for high data-rate transmission over fading channels. However, to deploy OFDM in a WLAN environment, precise frequency synchronization must be maintained and tricky frequency offsets must be handled. In this thesis, various techniques to improve the data throughput of OFDM WLAN are investigated. A simulation tool was developed in Matlab to evaluate the performance of the IEEE 802.1la physical layer. We propose a rapid time and frequency synchronization algorithm using only the short training sequence of the IEEE 802.1la standard, thus reducing the training overhead by 50%. Particular attention was paid to channel coding, block interleaving and antenna diversity. Computer simulation showed that drastic improvement in error rate performance is achievable when these techniques are deployed.
DTIC
Local Area Networks; Multiplexing

20040086208 Naval Postgraduate School, Monterey, CA
A CyberCIEGE Scenario Illustrating Multilevel Secrecy Issues in An Air Operations Center Environment
Meyer, Marc K.; Jun. 2004; 190 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424635; No Copyright; Avail: CASI; A09, Hardcopy

CyberCIEGE provides an addition to traditional Information Assurance (IA) education in the form of an interactive, entertaining, commercial-grade, PC-based computer game. Educational objectives are contained in scenarios that serve to teach particular IA concepts. The details of a scenario are contained in a Scenario Definition File (SDF), which is written in the CyberCIEGE Scenario Definition Language. This language is rich enough to express a range of information security policies and operational data access requirements, resulting in a nearly limitless pool of possible scenarios. This thesis developed a playable scenario illustrating confidentiality protection concepts in an open storage environment modeled after an Air Operations Center. Educational goals include physical protection of high-value assets and use of strong authentication policies to protect moderate value assets. The major work of this thesis was designing an SDF to reflect a military information security policy and work flow environment contained in the educational goals. The confirmation of the proper operation of selected aspects of the CyberCIEGE game engine, and the assurance that the SDF confronts the player with the security trade-offs occurred through the application of a testing methodology. The creation of detailed solutions and incorrect gameplay examples constituted this testing process. The appendix contains the complete scenario definition code of the three SDFs discussed in Chapter III, section C. (7 tables, 4 figures, 21 refs.)
DTIC
Computer Assisted Instruction; Computer Information Security; Computerized Simulation; Education; Security

20040086226 Naval Postgraduate School, Monterey, CA
Implementation of a Network Address Translation Mechanism Over IPv6
Baumgartner, Trevor J.; Phillips, Matthew D.; Jun. 2004; 270 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424655; No Copyright; Avail: CASI; A12, Hardcopy

Network Address Translation (NAT) for IPv4 was developed primarily to curb overcrowding of the Internet due to dwindling global IP addresses; however, NAT provides several other benefits. NAT can be used to mask the internal IP addresses of an Intranet - IPv6, the emerging standard for Internet addressing, provides three times the number of bits for IP addressing. While IPv6 does not need NAT for connectivity, other NAT features such as address hiding are valuable. There is currently no NAT implementation for IPv6. The focus of this research was the design and development of a NAT implementation for IPv6. This implementation will be used within a multilevel testbed. In addition, the NAT implementation developed here can facilitate the Department of Defense (DoD) transition to IPv6 planned for 2008 by providing services currently not available for IPv6. A working implementation of NAT for IPv6 within the Linux kernel has been produced The NAT development created here has been tested for Support of the protocols of TCP, UDP and ICMP for IPv6.
DTIC
Security; Translating

20040086284 Illinois Univ. at Urbana-Champaign, Urbana, IL
Service Continuity in Networked Control Using Etherware
Baliga, Girish; Graham, Scott R.; Sha, Lui; Kumar, P. R.; Jan. 2004; 22 pp.; In English
Report No.(s): AD-A424768; AFIT-CI-04-418; No Copyright; Avail: CASI; A03, Hardcopy

Service continuity is the capability to provide persistent and reliable service, with graceful degradation in the presence of changes. We contend that the implicit need for such a capability is the primary driver of middleware efforts today. This is particularly important for networked control systems interacting with the real world, as they have strict safety requirements. Such systems have to tolerate numerous changes, such as component faults, node failures, and software upgrades, while maintaining operational integrity. We focus on providing service continuity for networked control systems. The various changes in such systems are classified and illustrated using our traffic control testbed. We then describe how Etherware, our middle ware for networked control, handles these changes. Insights into co-design of Etherware, in conjunction with an implementation of our testbed, are presented. The ability of Etherware to provide service continuity, and the associated performance, is demonstrated through illustrative experiments.
DTIC
Computer Networks

20040086751 NASA Langley Research Center, Hampton, VA, USA
Self-Scheduling Parallel Methods for Multiple Serial Codes with Application to WOPWOP
Long, Lyle N.; Brentner, Kenneth S.; [2000]; 11 pp.; In English; 38th Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2000, Reno, NV, USA
Report No.(s): AIAA Paper 2000-0346; Copyright; Avail: CASI; A03, Hardcopy

This paper presents a scheme for efficiently running a large number of serial jobs on parallel computers. Two examples are given of computer programs that run relatively quickly, but often they must be run numerous times to obtain all the results needed. It is very common in science and engineering to have codes that are not massive computing challenges in themselves, but due to the number of instances that must be run, they do become large-scale computing problems. The two examples given here represent common problems in aerospace engineering: aerodynamic panel methods and aeroacoustic integral methods. The first example simply solves many systems of linear equations. This is representative of an aerodynamic panel code where someone would like to solve for numerous angles of attack. The complete code for this first example is included in the appendix so that it can be readily used by others as a template. The second example is an aeroacoustics code (WOPWOP) that solves the Ffowcs Williams Hawkings equation to predict the far-field sound due to rotating blades. In this example, one quite often needs to compute the sound at numerous observer locations, hence parallelization is utilized to automate the noise computation for a large number of observers.
Author
Computer Programs; Scheduling; Data Flow Analysis; Sequencing; Parallel Processing (Computers)

20040086914 NASA Ames Research Center, Moffett Field, CA, USA
Semantic Annotation of Computational Components
Vanderbilt, Peter; Mehrotra, Piyush; June 10, 2004; 10 pp.; In English; Global Grid Forum, Semantic Grid Workshop, 10 Jun. 2004, Honolulu, HI, USA
Contract(s)/Grant(s): NAS2-14303; RTOP 704-42-22; No Copyright; Avail: CASI; A02, Hardcopy
This paper describes a methodology to specify machine-processable semantic descriptions of computational components to enable them to be shared and reused. A particular focus of this scheme is to enable automatic compositon of such components into simple work-flows.
Author
Semantics; Methodology; Automatic Control; Computational Grids

20040086921 QSS Group, Inc., Moffett Field, CA, USA
Improving Evolvability through Generative Representations
Hornby, Gregory S.; [2004]; 4 pp.; In English; Genetic and Evolutionary COmputation Conference, 26-30 Jun. 2004, Seattle, WA, USA; No Copyright; Avail: CASI; A01, Hardcopy
One of the main limitations of computer automated design systems is the representation used for encoding designs. Using computer programs as an analogy, representations can be thought of as having the properties of combination, control-flow and abstraction. Generative representations are those which have the ability to reuse elements in an encoding through either iteration, a form of control-flow, or abstraction. Here we argue that generative representations improve the evolvability of designs by capturing design dependencies in a way that makes them easier to change, and we support this with examples from two design substrates.
Author
Computer Design; Automatic Control; Computer Programs; Analogies; Coding

20040086922 NASA Ames Research Center, Moffett Field, CA, USA, Research Inst. for Advanced Computer Science, Moffett Field, CA, USA
Networking Technologies Enable Advances in Earth Science
Johnson, Marjory; Freeman, Kenneth; Gilstrap, Raymond; Beck, Richard; April 27, 2004; 19 pp.; In English
Contract(s)/Grant(s): NCC2-1426; Copyright; Avail: CASI; A03, Hardcopy
This paper describes an experiment to prototype a new way of conducting science by applying networking and distributed computing technologies to an Earth Science application. A combination of satellite, wireless, and terrestrial networking provided geologists at a remote field site with interactive access to supercomputer facilities at two NASA centers, thus enabling them to validate and calibrate remotely sensed geological data in near-real time. This represents a fundamental shift in the way that Earth scientists analyze remotely sensed data. In this paper we describe the experiment and the network infrastructure that enabled it, analyze the data flow during the experiment, and discuss the scientific impact of the results.
Author
Earth Sciences; Computers; Information Flow; Real Time Operation; Prototypes; Remote Sensing

20040087129 Sandia National Labs., Albuquerque, NM, USA

Progressive Response Surfaces

Romero, V. J.; Swiler, L. P.; June 3, 2004; 9 pp.; In English; 9th ASCE EMD/SEI/GI/AD Joint Specialty Conference on Probabilistic Mechanics and Structural Reliability, 26028 Jul. 2004, Albuquerque, NM, USA

Contract(s)/Grant(s): 762-55-TH; No Copyright; Avail: CASI; A02, Hardcopy

Response surface functions are often used as simple and inexpensive replacements for computationally expensive computer models that simulate the behavior of a complex system over some parameter space. Progressive response surfaces are ones that are built up progressively as global information is added from new sample points in the parameter space. As the response surfaces are globally upgraded based on new information, heuristic indications of the convergence of the response surface approximation to the exact (fitted) function can be inferred. Sampling points can be incrementally added in a structured fashion, or in an unstructured fashion. Whatever the approach, at least in early stages of sampling it is usually desirable to sample the entire parameter space uniformly. At later stages of sampling, depending on the nature of the quantity being resolved, it may be desirable to continue sampling uniformly over the entire parameter space (Progressive response surfaces), or to switch to a focusing/economizing strategy of preferentially sampling certain regions of the parameter space based on information gained in early stages of sampling (Adaptive response surfaces). Here we consider Progressive response surfaces where a balanced indication of global response over the parameter space is desired.We use a variant of Moving Least Squares to fit and interpolate structured and unstructured point sets over the parameter space. On a 2-D test problem we compare response surface accuracy for three incremental sampling methods: Progressive Lattice Sampling; Simple-Random Monte Carlo; and Halton Quasi-Monte-Carlo sequences. We are ultimately after a system for constructing efficiently upgradable response surface approximations with reliable error estimates.

Author

Complex Systems; Sampling; Heuristic Methods; Computerized Simulation; Sequencing

20040090591 NASA Langley Research Center, Hampton, VA, USA

A Web-Based Monitoring System for Multidisciplinary Design Projects

Rogers, James L.; Salas, Andrea O.; Weston, Robert P.; [1998]; 9 pp.; In English

Report No.(s): AIAA Paper 98-4706; Copyright; Avail: CASI; A02, Hardcopy

In today's competitive environment, both industry and government agencies are under pressure to reduce the time and cost of multidisciplinary design projects. New tools have been introduced to assist in this process by facilitating the integration of and communication among diverse disciplinary codes. One such tool, a framework for multidisciplinary computational environments, is defined as a hardware and software architecture that enables integration, execution, and communication among diverse disciplinary processes. An examination of current frameworks reveals weaknesses in various areas, such as sequencing, displaying, monitoring, and controlling the design process. The objective of this research is to explore how Web technology, integrated with an existing framework, can improve these areas of weakness. This paper describes a Web-based system that optimizes and controls the execution sequence of design processes; and monitors the project status and results. The three-stage evolution of the system with increasingly complex problems demonstrates the feasibility of this approach.

Author

World Wide Web; Multidisciplinary Design Optimization; Architecture (Computers); Computer Systems Design

63
CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

Includes feedback and control theory, information theory, machine learning, and expert systems. For related information see also *54 Man/System Technology and Life Support*.

20040086136 North Carolina State Univ., Raleigh, NC

Segmentation Using Multispectral Adaptive Contours

Snyder, Wesley E.; Feb. 29, 2004; 48 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-03-1-0237

Report No.(s): AD-A424462; ARO-45753.1-C1-11; No Copyright; Avail: CASI; A03, Hardcopy

Funds are requested to pursue extension of the active contour model for image segmentation to images with multispectral measurements of target and background. The popular level set approach will be compared with the older 'snakes' approach

both theoretically and experimentally. The several different possible ways to make use of multispectral information about targets and clutter will be analyzed and experimentally compared.
DTIC
Contours; Image Processing; Segments

20040086137 North Carolina State Univ., Raleigh, NC
Topological Modeling and Stochastic Analysis of Images
Krim, Hamid; Apr. 30, 2004; 149 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0204
Report No.(s): AD-A424464; AFRL-SR-AR-TR-04-0327; No Copyright; Avail: CASI; A07, Hardcopy

In this report, we include the dissertation thesis the grant has funded together with a list of publications, and invitations the funded research has generated. Concepts in classification and recognition problems. 1. We have explored the potential of combining geometrical as well as topological information in capturing the essence of an object for classification and recognition purposes. The geometrical information within a topologically homogeneous part of an object is captured through a set of level curves, while the topology is extracted from the singular points. 2. Defining probability models on manifolds as would be required by the surface of an object remains a challenging topic. The approach here exploits a triangulated approximation on which a geodesic is defined to capture the nonlinear intrinsic structure of an object surface. 3. Obtaining distribution for objects in turn allows us to compare them by IT measures.
DTIC
Image Processing; Mathematical Models; Noise Reduction; Stochastic Processes

20040086176 Automation Integration of Information and Systems, OH
Detecting and Mining Similarities, Differences and Target Patterns in Sequences of Images Using the PFF, LGG and SPNG Approaches
Bourbakis, Despina; Jan. 2004; 49 pp.; In English
Contract(s)/Grant(s): F49620-03-C-0091
Report No.(s): AD-A424553; AFRL-SR-AR-TR-04-0370; No Copyright; Avail: CASI; A03, Hardcopy

In phase I the identification and significance of the problem was the mining images, especially sequences of images or video for detecting-extracting, fusing and recognizing differences, changes and associating patterns. These types of problems are difficult challenges in the image analysis and computer vision research community. These difficulties mainly due to the textural nature of the images and the possible noisy conditions during their capture. The recognition component was not a part of the phase I, but it belongs to phase II. We did it, however, in phase I in order to focus in phase II on the integration and real-time issues. Thus, for the achievement of the phase I tasks (objectives), we have developed and/or used several methods such as Pixel Flow Functions (PFF) (or projections), Segmentation, Local Global Graphs (L-G), Genetic Algorithms (GAs). Registration (or Mapping), Curve Fitting. Wavelets, Region Synthesis, Stochastic Petri-Nets (SPNs), and others. The efficient uses of these methods in a certain sequence has produced the desirable results for each of the tasks. Here we present each task and the sequence of methods involved for obtaining
DTIC
Aerial Photography; Analogies; Detection; Image Processing; Mining; Pattern Registration; Sequencing; Targets

20040086205 Air War Coll., Maxwell AFB, AL
Anatomy of Cyberterrorism: Is America Vulnerable?
Ashley, Bradley K.; Feb. 27, 2003; 52 pp.; In English
Report No.(s): AD-A424625; No Copyright; Avail: CASI; A04, Hardcopy

The USA is vulnerable to attacks from cyberterrorists. A ‘Digital World Trade Center Attack", possibly killing thousands and causing billions of dollars in damage. This paper will provide fundamental background information on what cyberterror is and what it means. It also presents a model to understand the anatomy of cyberterrorism, describing some real-world cyber events, assesses cyberterrorist capabilities, and finally makes specific recommendations for improvement in cyber security. This paper begins with a chilling scenario of cyberterror illustrating many aspects of potential future actions. The scenario is based 100% on real-world events that occurred within the past few years. The cyberterrorism model describes the anatomy of cyberterror and its components. It is a descriptive model and not a prescriptive model. In order to fully understand cyberterror, one must% first understand the cyberspace environment and its unique attributes. Then by analyzing the various components of the cyberterror anatomy, we can grasp the answers to basic questions: who, what how, where, why,

and when. Only after one understands these basic pillars, can one fully understand the whole of cyberterrorism. The events of 9/11 caught us by surprise. We were unprepared and we now must broaden our expanded defense to include the cyber threat. Unless we take the appropriate steps to protect ourselves against cyber attacks now, America will surely suffer tragic cyberterrorist attacks that will have devastating impacts on our economy and will include loss of life.
DTIC
Anatomy

20040086282 SRI International Corp., Menlo Park, CA
Plan Authoring Based on Sketches, Advice and Templates
Myers, Karen L.; Jarvis, Peter A.; Lee, Thomas J.; Tyson, W. M.; Wolverton, Michael J.; Jun. 2004; 99 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-C-0058; Proj-ATEM
Report No.(s): AD-A424765; AFRL-IF-RS-TR-2004-145; No Copyright; Avail: CASI; A05, Hardcopy

Artificial intelligence (AI) planning technology provides powerful tools for solving problems that require the coordination of actions in the pursuit of specified goals. To date, however, there has been limited success in transitioning this technology to significant applications in the commercial, military, and space sectors. A major obstacle to technology transfer lies with the lack of control available to potential users of planning systems. Al planning systems have traditionally been designed to operate as black boxes that take a description of a domain and a set of goals and automatically synthesize a plan for achieving the goals. Many potential consumers of planning technology require more user- centric tools that are designed to augment human skills rather than replace them. Both the military and space communities are showing tremendous interest in user-centric planning technology that combines plan authoring and automated decision aids. The main focus of this project was the development of the PASSAT system (Plan Authoring based on Sketches, Advice, and Templates), a mixed-initiative framework for developing complex, hierarchical plans. With its combination of interactive and automated capabilities, PASSAT enables a user to quickly develop plans that draw upon past experience encoded in templates but that are customized to individual preferences and the demands of the current situation.
DTIC
Artificial Intelligence; Templates

20040086884 QSS Group, Inc., Moffett Field, CA, USA, NASA Ames Research Center, Moffett Field, CA, USA
Aerial Explorers and Robotic Ecosystems
Young, Larry A.; Pisanich, Greg; [2004]; 8 pp.; In English; International Conference on Computing, Communications and Control Technologies: CCCT'04, The International Institute of Informatics and Systemics, 14-17 Aug. 2004, Austin, TX, USA; No Copyright; Avail: CASI; A02, Hardcopy

A unique bio-inspired approach to autonomous aerial vehicle, a.k.a. aerial explorer technology is discussed. The work is focused on defining and studying aerial explorer mission concepts, both as an individual robotic system and as a member of a small robotic 'ecosystem.' Members of this robotic ecosystem include the aerial explorer, air-deployed sensors and robotic symbiotes, and other assets such as rovers, landers, and orbiters.
Author
Ecosystems; Robotics; Space Exploration; Roving Vehicles

20040086924 QSS Group, Inc., Moffett Field, CA, USA
Using Generative Representations to Evolve Robots, Chapter 1
Hornby, Gregory S.; [2004]; 26 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Recent research has demonstrated the ability of evolutionary algorithms to automatically design both the physical structure and software controller of real physical robots. One of the challenges for these automated design systems is to improve their ability to scale to the high complexities found in real-world problems. Here we claim that for automated design systems to scale in complexity they must use a representation which allows for the hierarchical creation and reuse of modules, which we call a generative representation. Not only is the ability to reuse modules necessary for functional scalability, but it is also valuable for improving efficiency in testing and construction. We then describe an evolutionary design system with a generative representation capable of hierarchical modularity and demonstrate it for the design of locomoting robots in simulation. Finally, results from our experiments show that evolution with our generative representation produces better robots than those evolved with a non-generative representation.
Author
Robots; Automatic Control; Controllers; Algorithms; Modularity

20040086927 NASA Ames Research Center, Moffett Field, CA, USA
Grid Technology as a Cyber Infrastructure for Earth Science Applications
Hinke, Thomas H.; May 13, 2004; 9 pp.; In English; Earth Science Technology Conference, 22 Jun. 2004, Palo Alto, CA, USA; No Copyright; Avail: CASI; A02, Hardcopy

This paper describes how grids and grid service technologies can be used to develop an infrastructure for the Earth Science community. This cyberinfrastructure would be populated with a hierarchy of services, including discipline specific services such those needed by the Earth Science community as well as a set of core services that are needed by most applications. This core would include data-oriented services used for accessing and moving data as well as computer-oriented services used to broker access to resources and control the execution of tasks on the grid. The availability of such an Earth Science cyberinfrastructure would ease the development of Earth Science applications. With such a cyberinfrastructure, application work flows could be created to extract data from one or more of the Earth Science archives and then process it by passing it through various persistent services that are part of the persistent cyberinfrastructure, such as services to perform subsetting, reformatting, data mining and map projections.
Author
Computational Grids; Technology Utilization; Earth Sciences; NASA Space Programs; Artificial Intelligence

20040086981 NASA Ames Research Center, Moffett Field, CA, USA
NASA Altix 512P SSI
Chan, Davin; [2004]; 16 pp.; In English; SGI User Conference, 23-27 May 2004, Orlando, FL, USA
Contract(s)/Grant(s): DTTS59-99-D-00437; 107N10-10259.001.00203; NASA Order A-61812-D; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents a general overview of NASA Advances Supercomputing (NAS). The topics include: 1) About NASA Advanced Supercomputing (NAS); 2) System Configuration; 3) Our Experience with the Altix; and 4) Future Plans.
CASI
NASA Programs; Systems Engineering; Supercomputers; Computer Systems Programs

20040087094 NASA Ames Research Center, Moffett Field, CA, USA
Middleware and Web Services for the Collaborative Information Portal of NASA's Mars Exploration Rovers Mission
Sinderson, Elias; Magapu, Vish; Mak, Ronald; [2004]; 14 pp.; In English; International Middleware Conference, 18-22 Oct. 2004, Toronto, Canada; No Copyright; Avail: CASI; A03, Hardcopy

We describe the design and deployment of the middleware for the Collaborative Information Portal (CIP), a mission critical J2EE application developed for NASA's 2003 Mars Exploration Rover mission. CIP enabled mission personnel to access data and images sent back from Mars, staff and event schedules, broadcast messages and clocks displaying various Earth and Mars time zones. We developed the CIP middleware in less than two years time usins cutting-edge technologies, including EJBs, servlets, JDBC, JNDI and JMS. The middleware was designed as a collection of independent, hot-deployable web services, providing secure access to back end file systems and databases. Throughout the middleware we enabled crosscutting capabilities such as runtime service configuration, security, logging and remote monitoring. This paper presents our approach to mitigating the challenges we faced, concluding with a review of the lessons we learned from this project and noting what we'd do differently and why.
Author
Mars Exploration; Mars Roving Vehicles; World Wide Web; NASA Space Programs; Architecture (Computers); Information Retrieval

20040090442 NASA Langley Research Center, Hampton, VA, USA
Design of Neural Networks for Fast Convergence and Accuracy
Maghami, Peiman G.; Sparks, Dean W., Jr.; [1998]; 11 pp.; In English
Report No.(s): AIAA Paper 98-1780; Copyright; Avail: CASI; A03, Hardcopy

A novel procedure for the design and training of artificial neural networks, used for rapid and efficient controls and dynamics design and analysis for flexible space systems, has been developed. Artificial neural networks are employed to provide a means of evaluating the impact of design changes rapidly. Specifically, two-layer feedforward neural networks are designed to approximate the functional relationship between the component spacecraft design changes and measures of its performance. A training algorithm, based on statistical sampling theory, is presented, which guarantees that the trained networks provide a designer-specified degree of accuracy in mapping the functional relationship. Within each iteration of this

statistical-based algorithm, a sequential design algorithm is used for the design and training of the feedforward network to provide rapid convergence to the network goals. Here, at each sequence a new network is trained to minimize the error of previous network. The design algorithm attempts to avoid the local minima phenomenon that hampers the traditional network training. A numerical example is performed on a spacecraft application in order to demonstrate the feasibility of the proposed approach.
Author
Convergence; Design Analysis; Feedforward Control; Neural Nets; Artificial Intelligence; Mathematical Models; Accuracy

64
NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20040086119 California Univ., Irvine, CA
Quantum Computing and Information Transfer by Optical Manipulation of Molecular Coherences
Apkarian, V. A.; Jan. 2004; 6 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0449
Report No.(s): AD-A424420; AFRL-SR-AR-TR-04-0326; No Copyright; Avail: CASI; A02, Hardcopy

While formally quantum computation has become a rather well defined theoretical science, physical demonstrations are few, limited to several qubits, and to several steps in processing. At present, there is not a recognized, scalable physical method of implementation that meets the promise of true computation. We have proposed nonlinear spectroscopic methods of coherence manipulation, and in particular, Time-Frequency Resolved Coherent Anti-Stokes Raman Scattering (TFRCARS) in the molecular re-vibronic Hilbert space as a novel scheme for implementing quantum logic. The method has advantages with its demonstrable massive parallelism, therefore well suited for information transfer, while its scalability remains unresolved, both theoretically and with regard to physical implementations. We are actively following the latter, with the concept of an inhomogeneously indexed array of single quantum centers as the physical realization.
DTIC
Coherent Scattering; Information Transfer; Quantum Computation; Quantum Theory

20040086140 Texas Univ., Arlington, TX
Alloys-by-Design Strategies Using Stochastic Multi- Objective Optimization
Dulikravich, George S.; Aug. 31, 2003; 58 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-02-1-0363
Report No.(s): AD-A424471; 26-0401-09-REP-02; ARO-43342.2-MS; No Copyright; Avail: CASI; A04, Hardcopy

The objective was to develop and demonstrate a technique for multi-objective optimization of the chemical composition of steel alloys with the use of an existing experimental database. The technique involves organization and execution of an iterative optimization experiment, which results in a set of Pareto optimum chemical compositions. The algorithms of response surface building known as IOSO was used where the response surfaces are built in accordance with existing experimental information. In a set of experiments the information on alloy properties in Pareto set neighborhood is accumulated, which makes it possible to increase the accuracy of results obtained. After each iteration of this technique, a set of new alloy compositions is formed which are assumed to be Pareto optimal, and for which experiment evaluation of properties should be carried out. For this work, algorithms of artificial neural networks were used that utilized radial- basis functions modified in order to build the response surfaces. The modifications consisted in the selection of ANN parameters at the stage of their training that are based on two criteria: minimal curvature of response surface, and provision of the best predictive properties for given subset of test points. The procedure was demonstrated to work successful and efficient
DTIC
Stochastic Processes

20040086144 Arkansas Univ., Fayetteville, AR
Adaptive Navier Stokes Flow Solver for Aerospace Structures
Selvam, R. P.; Qu, Zu-Qing; May 2004; 56 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0309
Report No.(s): AD-A424479; AFRL-SR-AR-TR-04-0371; No Copyright; Avail: CASI; A04, Hardcopy

Predicting wind induced aerodynamic forces on aerospace structures is usually computationally expensive even for

powerful computational facilities. For these unsteady computations, adaptive finite element technique may reduce the computer time and storage while keeping a desired accuracy. In this report, the p-version adaptive finite element method is implemented into a standard benchmark problem, the computational how around a circular cylinder, to compute aerodynamic forces. The error distribution for velocity is first estimated. Then, the polynomial order of the interpolation function is changed continuously in accordance with the changing of the error distribution. The second through fifth orders of polynomials are considered for the velocity in the adaptive method. One order less of polynomial is used for pressure. The benchmark problem of the flow around a circular cylinder with Reynolds number of 1000 is considered to study the performance.
DTIC
Aerodynamic Forces; Aircraft Structures; Finite Element Method; Stokes Flow

20040086188 Virginia Univ., Charlottesville, VA
Clutter-Reducing, Scalable Image Processing Methods for Target Acquisition and Tracking
Acton, Scott T.; Ray, Nilanjan; Jun. 10, 2004; 20 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-01-1-0594
Report No.(s): AD-A424575; 110717; ARO-41628.13-CI; No Copyright; Avail: CASI; A03, Hardcopy

A three year ARO project has resulted in important novel non-linear image processing techniques that aim to facilitate target detection and tracking from video sequences involving severe clutter and change of target scale. One of the non-linear techniques developed is the morphological locally monotonic (LOMO) filter. Morphological LOMO filter is scalable to target sizes and eases scale sensitive target detection. Another significant development is the speckle reducing an isotropic difflision (SRAD) method for eradicating clutter and noise from radar and ultrasound imagery. A third development is a generic connected filtering technique called the inclusion filter, which has been shown to improve tracking in clutter. Target shape and size as well as other set theoretic criteria can be constrained using the inclusion filter, without distorting target edges. Yet another significant advancement in target tracking has been made through developing projection model active contour models and related Monte Carlo methods. The projection model tracking methods have been shown to be resilient to severe clutter and change of target scales. The ARO project has supported 10 graduate students and 3 undergraduate students in the process of earning engineering degrees from University of Virginia. The project has also led to over 25 peer reviewed publications.
DTIC
Automatic Control; Clutter; Image Processing; Target Acquisition; Tracking (Position)

20040086260 Naval Postgraduate School, Monterey, CA
Infrared Face Recognition
Lee, Colin K.; Jun. 2004; 155 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424713; No Copyright; Avail: CASI; A08, Hardcopy

This study continues a previous face recognition investigation using uncooled infrared technology. The database developed in an earlier study is further expanded to include 50 volunteers with 30 facial images from each subject. The automatic image reduction method reduces the pixel size of each image from 160x120 to 60x45 . The study reexamines two linear classification methods: the Principal Component Analysis (PCA) and Fisher Linear Discriminant Analysis (LDA). Both PCA and LDA apply eigenvectors and eigenvalues concepts. In addition, the Singular Value Decomposition based Snapshot method is applied to decrease the computational load. The K- fold Cross Validation is applied to estimate classification performances. Results indicate that the best PCA-based method (using all eigenvectors) produces an average classification performance equal to 79.22%. Incorporated with PCA for dimension reduction, the LDA-based method achieves 94.58% accuracy in average classification performance. Additional testing on unfocused images produces no significant impact on the overall classification performance. Overall results again confirm uncooled IR imaging can be used to identify individual subjects in a constrained indoor environment.
DTIC
Face (Anatomy); Image Processing; Infrared Imagery; Infrared Radiation

20040086553 NASA Langley Research Center, Hampton, VA, USA
TIGER: Development of Thermal Gradient Compensation Algorithms and Techniques
Hereford, James; Parker, Peter A.; Rhew, Ray D.; [2004]; 11 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

In a wind tunnel facility, the direct measurement of forces and moments induced on the model are performed by a force measurement balance. The measurement balance is a precision-machined device that has strain gages at strategic locations to measure the strain (i.e., deformations) due to applied forces and moments. The strain gages convert the strain (and hence the

applied force) to an electrical voltage that is measured by external instruments. To address the problem of thermal gradients on the force measurement balance NASA-LaRC has initiated a research program called TIGER - Thermally-Induced Gradients Effects Research. The ultimate goals of the TIGER program are to: (a) understand the physics of the thermally-induced strain and its subsequent impact on load measurements and (b) develop a robust thermal gradient compensation technique. This paper will discuss the impact of thermal gradients on force measurement balances, specific aspects of the TIGER program (the design of a special-purpose balance, data acquisition and data analysis challenges), and give an overall summary.
Author
Algorithms; Data Acquisition; Deformation; Force Distribution

20040086572 Cambridge Univ., Cambridge, UK
Stability of Lobed Balloons
Ball, Danny, Technical Monitor; Pagitz, M.; Pellegrino, Xu S.; August 12, 2004; 23 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents a computational study of the stability of simple lobed balloon structures. Two approaches are presented, one based on a wrinkled material model and one based on a variable Poisson s ratio model that eliminates compressive stresses iteratively. The first approach is used to investigate the stability of both a single isotensoid and a stack of four isotensoids, for perturbations of in.nitesimally small amplitude. It is found that both structures are stable for global deformation modes, but unstable for local modes at su.ciently large pressure. Both structures are stable if an isotropic model is assumed. The second approach is used to investigate the stability of the isotensoid stack for large shape perturbations, taking into account contact between di.erent surfaces. For this structure a distorted, stable configuration is found. It is also found that the volume enclosed by this con.guration is smaller than that enclosed by the undistorted structure.
Author
Computation; Stability; Balloons; Structural Analysis; Isotensoid Structures

20040086590 Istituto Nazionale di Fisica Nucleare, Milan, Italy
Near Field Scattering
Potenza, Marco A. C.; Brogioli, Doriano; Vailati, Alberto; Giglio, Marzio; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 32-34; In English; See also 20040086587; No Copyright; Avail: CASI; A01, Hardcopy

We present a novel scattering technique based on the statistical analysis of the random intensity distribution in the near field of the light scattered by a sample.
Author
Statistical Analysis; Scattering; Near Fields

20040086595 University of Central Florida, Orlando, FL, USA
Statistics of Optical Near-Fields
Dogariu, A.; Apostol, A.; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 29-31; In English; See also 20040086587; No Copyright; Avail: CASI; A01, Hardcopy

We demonstrate that the second-order statistics and the spectral density in the close proximity of an optically inhomogeneous medium are quite different from the farfield properties of radiation and are determined by the statistical characteristics of the interface.
Author
Statistical Analysis; Density; Spectrum Analysis

20040086636 NASA Langley Research Center, Hampton, VA, USA
Motion Cueing Algorithms: A Human Centered Approach
Cardullo, Frank M.; Telban, Robert J.; Houck, Jacob A.; [2004]; 11 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

A key element in providing physical stimuli in flight simulators is the cueing algorithm that produces the drive signals used to control the motion system hardware. Two approaches to motion cueing algorithm development have been identified from state of the art research. The first technique, the ‘adaptive algorithm", combines first and second order linear washout filters with an optimization method to adjust the filter gains in real time based upon the error between the simulated vehicle and the motion platform responses. The methodology effectively produces a nonlinear filter. The second technique, the

‘optimal algorithm", uses higher order filters that are developed prior to real time application using optimal control methods. The latter method incorporates a mathematical model of the human vestibular system, constraining the sensation error between the simulated vehicle and the motion platform dynamics.
Author
Algorithms; Cues; Vestibules; Optimal Control; Flight Simulators

20040086687 NASA Langley Research Center, Hampton, VA, USA
Analytical Bistatic k Space Images Compared to Experimental Swept Frequency EAR Images
Shaeffer, John; Cooper, Brett; Hom, Kam; [2004]; 7 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

A case study of flat plate scattering images obtained by the analytical bistatic k space and experimental swept frequency ISAR methods is presented. The key advantage of the bistatic k space image is that a single excitation is required, i.e., one frequency I one angle. This means that prediction approaches such as MOM only need to compute one solution at a single frequency. Bistatic image Fourier transform data are obtained by computing the scattered field at various bistatic positions about the body in k space. Experimental image Fourier transform data are obtained from the measured response to a bandwidth of frequencies over a target rotation range.
Author
Numerical Analysis; Fourier Transformation; Flat Plates; Synthetic Aperture Radar

20040086718 NASA Langley Research Center, Hampton, VA, USA
Real-time Adaptive Control Using Neural Generalized Predictive Control
Haley, Pam; Soloway, Don; Gold, Brian; [1999]; 5 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The objective of this paper is to demonstrate the feasibility of a Nonlinear Generalized Predictive Control algorithm by showing real-time adaptive control on a plant with relatively fast time-constants. Generalized Predictive Control has classically been used in process control where linear control laws were formulated for plants with relatively slow time-constants. The plant of interest for this paper is a magnetic levitation device that is nonlinear and open-loop unstable. In this application, the reference model of the plant is a neural network that has an embedded nominal linear model in the network weights. The control based on the linear model provides initial stability at the beginning of network training. In using a neural network the control laws are nonlinear and online adaptation of the model is possible to capture unmodeled or time-varying dynamics. Newton-Raphson is the minimization algorithm. Newton-Raphson requires the calculation of the Hessian, but even with this computational expense the low iteration rate make this a viable algorithm for real-time control.
Author
Real Time Operation; Adaptive Control; Feasibility Analysis; Nonlinearity; Predictions; Network Control; Algorithms

20040086793 NASA Langley Research Center, Hampton, VA, USA
An O(Nm(sup 2)) Plane Solver for the Compressible Navier-Stokes Equations
Thomas, J. L.; Bonhaus, D. L.; Anderson, W. K.; Rumsey, C. L.; Biedron, R. T.; [1999]; 17 pp.; In English; 37th AIAA Aerospace Sciences Meeting and Exhibit, 11-14 Jan. 1999, Reno, NV, USA
Report No.(s): AIAA Paper 99-0785; Copyright; Avail: CASI; A03, Hardcopy

A hierarchical multigrid algorithm for efficient steady solutions to the two-dimensional compressible Navier-Stokes equations is developed and demonstrated. The algorithm applies multigrid in two ways: a Full Approximation Scheme (FAS) for a nonlinear residual equation and a Correction Scheme (CS) for a linearized defect correction implicit equation. Multigrid analyses which include the effect of boundary conditions in one direction are used to estimate the convergence rate of the algorithm for a model convection equation. Three alternating-line- implicit algorithms are compared in terms of efficiency. The analyses indicate that full multigrid efficiency is not attained in the general case; the number of cycles to attain convergence is dependent on the mesh density for high-frequency cross-stream variations. However, the dependence is reasonably small and fast convergence is eventually attained for any given frequency with either the FAS or the CS scheme alone. The paper summarizes numerical computations for which convergence has been attained to within truncation error in a few multigrid cycles for both inviscid and viscous ow simulations on highly stretched meshes.
Author
Algorithms; Boundary Conditions; Computational Grids; Two Dimensional Models; Navier-Stokes Equation

20040086821 NASA Langley Research Center, Hampton, VA, USA
Nonlinear Local Bending Response and Bulging Factors for Longitudinal Cracks in Pressurized Cylindrical Shells
Rose, Cheryl A.; Young, Richard D.; Starnes, James H., Jr.; [1999]; 10 pp.; In English
Report No.(s): AIAA Paper 99-1412; Copyright; Avail: CASI; A02, Hardcopy

Results of a geometrically nonlinear finite element parametric study to determine curvature correction factors or ‘bulging factors’ that account for increased stresses due to curvature for longitudinal cracks in unstiffened pressurized cylindrical shells are presented. Geometric parameters varied in the study include the shell radius, the shell wall thickness, and the crack length. The major results are presented in graphs of the bulging factor as a function of the applied load and as a function of geometric parameters that include the shell radius, the shell thickness and the crack length. The computed bulging factors are compared with solutions based on linear shallow shell theory, and with semi-empirical solutions that approximately account for the nonlinear deformation in the vicinity of the crack. The effect of biaxial loads on the computed bulging factors is also discussed.
Author
Nonlinearity; Bending; Bulging; Crack Propagation; Cylindrical Shells; Pressurizing

20040086828 NASA Ames Research Center, Moffett Field, CA, USA
Linearity-Preserving Limiters on Irregular Grids
Berger, Marsha; Aftosmis, Michael; Murman, Scott; May 05, 2004; 23 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 6-11 Jan. 2005, Reno, NV, USA
Contract(s)/Grant(s): 704-41-11; No Copyright; Avail: CASI; A03, Hardcopy

This paper examines the behavior of flux and slope limiters on non-uniform grids in multiple dimensions. We note that on non-uniform grids the scalar formulation in standard use today sacrifices k-exactness, even for linear solutions, impacting both accuracy and convergence. We rewrite some well-known limiters in a n way to highlight their underlying symmetry, and use this to examine both traditional and novel limiter formulations. A consistent method of handling stretched meshes is developed, as is a new directional formulation in multiple dimensions for irregular grids. Results are presented demonstrating improved accuracy and convergence using a combination of model problems and complex three-dimensional examples.
Author
Computational Grids; Nonuniformity; Slopes

20040086833 NASA Langley Research Center, Hampton, VA, USA
An Adaptive Unstructured Grid Method by Grid Subdivision, Local Remeshing, and Grid Movement
Pirzadeh, Shahyar Z.; [1999]; 12 pp.; In English; 14th AIAA Computational Fluid Dynamics Conference, 28 Jun. - 1 Jul. 1999, Norfolk, VA, USA
Report No.(s): AIAA Paper 99-3255; Copyright; Avail: CASI; A03, Hardcopy

An unstructured grid adaptation technique has been developed and successfully applied to several three dimensional inviscid flow test cases. The approach is based on a combination of grid subdivision, local remeshing, and grid movement. For solution adaptive grids, the surface triangulation is locally refined by grid subdivision, and the tetrahedral grid in the field is partially remeshed at locations of dominant flow features. A grid redistribution strategy is employed for geometric adaptation of volume grids to moving or deforming surfaces. The method is automatic and fast and is designed for modular coupling with different solvers. Several steady state test cases with different inviscid flow features were tested for grid/solution adaptation. In all cases, the dominant flow features, such as shocks and vortices, were accurately and efficiently predicted with the present approach. A new and robust method of moving tetrahedral ‘viscous’ grids is also presented and demonstrated on a three-dimensional example.
Author
Computational Grids; Three Dimensional Flow; Unstructured Grids (Mathematics)

20040086839 NASA Langley Research Center, Hampton, VA, USA
On Multi-Dimensional Unstructured Mesh Adaption
Wood, William A.; Kleb, William L.; [1999]; 16 pp.; In English; 14th AIAA Computational Fluid Dynamics Conference, 28 Jun. - 1 Jul. 1999, Norfolk, VA, USA
Report No.(s): AIAA Paper 99-3254; Copyright; Avail: CASI; A03, Hardcopy

Anisotropic unstructured mesh adaption is developed for a truly multi-dimensional upwind fluctuation splitting scheme, as applied to scalar advection-diffusion. The adaption is performed locally using edge swapping, point insertion/deletion, and nodal displacements. Comparisons are made versus the current state of the art for aggressive anisotropic unstructured adaption, which is based on a posteriori error estimates. Demonstration of both schemes to model problems, with features representative of compressible gas dynamics, show the present method to be superior to the a posteriori adaption for linear advection. The performance of the two methods is more similar when applied to nonlinear advection, with a difference in the treatment of shocks. The a posteriori adaption can excessively cluster points to a shock, while the present multi-dimensional scheme tends

to merely align with a shock, using fewer nodes. As a consequence of this alignment tendency, an implementation of eigenvalue limiting for the suppression of expansion shocks is developed for the multi-dimensional distribution scheme. The differences in the treatment of shocks by the adaption schemes, along with the inherently low levels of artificial dissipation in the fluctuation splitting solver, suggest the present method is a strong candidate for applications to compressible gas dynamics.
Derived from text
Unstructured Grids (Mathematics); Upwind Schemes (Mathematics); Error Analysis; Anisotropy

20040086843 NASA Langley Research Center, Hampton, VA, USA
A Pseudo-Temporal Multi-Grid Relaxation Scheme for Solving the Parabolized Navier-Stokes Equations
White, J. A.; Morrison, J. H.; [1999]; 16 pp.; In English; 14th AIAA Computational Fluid Dynamics Conference, 28 Jun. - 1 Jul. 1999, Norfolk, VA, USA
Report No.(s): AIAA Paper 99-3360; Copyright; Avail: CASI; A03, Hardcopy

A multi-grid, flux-difference-split, finite-volume code, VULCAN, is presented for solving the elliptic and parabolized form of the equations governing three-dimensional, turbulent, calorically perfect and non-equilibrium chemically reacting flows. The space marching algorithms developed to improve convergence rate and or reduce computational cost are emphasized. The algorithms presented are extensions to the class of implicit pseudo-time iterative, upwind space-marching schemes. A full approximate storage, full multi-grid scheme is also described which is used to accelerate the convergence of a Gauss-Seidel relaxation method. The multi-grid algorithm is shown to significantly improve convergence on high aspect ratio grids.
Author
Grid Generation (Mathematics); Navier-Stokes Equation; Upwind Schemes (Mathematics); Convergence; Algorithms

20040086847 NASA Langley Research Center, Hampton, VA, USA
Distributed Relaxation Multigrid and Defect Correction Applied to the Compressible Navier-Stokes Equations
Thomas, J. L.; Diskin, B.; Brandt, A.; [1999]; 9 pp.; In English; 14th Computational Fluid Dynamics Conference, 28 Jun. - 1 Jul. 1999, Norfolk, VA, USA
Report No.(s): AIAA Paper 99-3334; Copyright; Avail: CASI; A02, Hardcopy

The distributed-relaxation multigrid and defect- correction methods are applied to the two- dimensional compressible Navier-Stokes equations. The formulation is intended for high Reynolds number applications and several applications are made at a laminar Reynolds number of 10,000. A staggered- grid arrangement of variables is used; the coupled pressure and internal energy equations are solved together with multigrid, requiring a block 2x2 matrix solution. Textbook multigrid efficiencies are attained for incompressible and slightly compressible simulations of the boundary layer on a flat plate. Textbook efficiencies are obtained for compressible simulations up to Mach numbers of 0.7 for a viscous wake simulation.
Author
Navier-Stokes Equation; Reynolds Number; Wakes; Two Dimensional Models

20040086855 NASA Langley Research Center, Hampton, VA, USA
Efficient Implementations of the Quadrature-Free Discontinuous Galerkin Method
Lockard, David P.; Atkins, Harold L.; [1999]; 12 pp.; In English; 14th AIAA CFD Conference, 28 Jun. - 1 Jul. 1999, Norfolk, VA, USA
Report No.(s): AIAA Paper 99-3309; Copyright; Avail: CASI; A03, Hardcopy

The efficiency of the quadrature-free form of the dis- continuous Galerkin method in two dimensions, and briefly in three dimensions, is examined. Most of the work for constant-coefficient, linear problems involves the volume and edge integrations, and the transformation of information from the volume to the edges. These operations can be viewed as matrix-vector multiplications. Many of the matrices are sparse as a result of symmetry, and blocking and specialized multiplication routines are used to account for the sparsity. By optimizing these operations, a 35% reduction in total CPU time is achieved. For nonlinear problems, the calculation of the flux becomes dominant because of the cost associated with polynomial products and inversion. This component of the work can be reduced by up to 75% when the products are approximated by truncating terms. Because the cost is high for nonlinear problems on general elements, it is suggested that simplified physics and the most efficient element types be used over most of the domain.
Author
Galerkin Method; Matrices (Mathematics); Quadratures

20040086917 NASA Ames Research Center, Moffett Field, CA, USA

Discontinuous Spectral Difference Method for Conservation Laws on Unstructured Grids

Liu, Yen; Vinokur, Marcel; Wang, Z. J.; June 18, 2004; 6 pp.; In English; Third ICCFD Conference, 12-16 Jul. 2004, Toronto, Canada; Copyright; Avail: CASI; A02, Hardcopy

A new, high-order, conservative, and efficient method for conservation laws on unstructured grids is developed. The concept of discontinuous and high-order local representations to achieve conservation and high accuracy is utilized in a manner similar to the Discontinuous Galerkin (DG) and the Spectral Volume (SV) methods, but while these methods are based on the integrated forms of the equations, the new method is based on the differential form to attain a simpler formulation and higher efficiency. A discussion on the Discontinuous Spectral Difference (SD) Method, locations of the unknowns and flux points and numerical results are also presented.

Derived from text

Conservation Laws; Spectral Methods; Unstructured Grids (Mathematics); Discontinuity

20040086923 NASA Ames Research Center, Moffett Field, CA, USA

Multi-Dimensional Spectral Difference Method for Unstructured Grids

Liu, Yen; Vinokur, Marcel; [2005]; 11 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA; No Copyright; Avail: CASI; A03, Hardcopy

A new, high-order, conservative, and efficient method for conservation laws on unstructured grids is developed. It combines the best features of structured and unstructured grid methods to attain computational efficiency and geometric flexibility; it utilizes the concept of discontinuous and high-order local representations to achieve conservation and high accuracy; and it is based on the finite-difference formulation for simplicity. Universal reconstructions are obtained by distributing unknowns in a geometrically similar manner for all unstructured cells. Placements of the unknown and flux points with various order of accuracy are given for the line, triangular and tetrahedral elements. The data structure of the new method permits an optimum use of cache memory, resulting in further computational efficiency on modern computers. A new pointer system is developed that reduces memory requirements and simplifies programming for any order of accuracy. Numerical solutions are presented and compared with the exact solutions for wave propagation problems in both two and three dimensions to demonstrate the capability of the method. Excellent agreement has been found. The method is simpler and more efficient than previous discontinuous Galerkin and spectral volume methods for unstructured grids.

Author

Conservation Laws; Unstructured Grids (Mathematics); Structured Grids (Mathematics); Numerical Analysis; Finite Difference Theory; Data Structures

20040087031 NASA Langley Research Center, Hampton, VA, USA

Substructure Synthesis: A Controls Approach

Maghami, Peiman G.; Lim, Kyong B.; [1999]; 8 pp.; In English

Report No.(s): AIAA Paper 99-3957; Copyright; Avail: CASI; A02, Hardcopy

Substructure synthesis from a controls perspective is considered. An efficient and computationally robust method for synthesis of substructures is developed. The method considers the interface forces/moments as control inputs and redefines the synthesis problem in terms of obtaining a constant gain compensator which would ensure the connectivity requirements of the combined structure. Orthogonal similarity transformations are used to provide simplified synthesized dynamics of the combined system. The simplicity of form in transformed coordinates are exploited to effectively deal with modeling parametric and non-parametric uncertainties at substructure level. Uncertainty models of reasonable size and complexity are derived for the combined structure from those in the substructure models.

Author

Substructures; Computation; Robustness (Mathematics)

20040087037 NASA Langley Research Center, Hampton, VA, USA

Uncertainty Modeling Via Frequency Domain Model Validation

Waszak, Martin R.; Andrisani, Dominick, II; [1999]; 11 pp.; In English

Report No.(s): AIAA Paper 99-3959; Copyright; Avail: CASI; A03, Hardcopy

Abstract The majority of literature on robust control assumes that a design model is available and that the uncertainty model bounds the actual variations about the nominal model. However, methods for generating accurate design models have not received as much attention in the literature. The influence of the level of accuracy of the uncertainty model on closed loop

performance has received even less attention. The research reported herein is an initial step in applying and extending the concept of model validation to the problem of obtaining practical uncertainty models for robust control analysis and design applications. An extension of model validation called 'sequential validation' is presented and applied to a simple spring-mass-damper system to establish the feasibility of the approach and demonstrate the benefits of the new developments.
Author
Accuracy; Models; Design Analysis; Proving

20040087105 NASA Langley Research Center, Hampton, VA, USA
Real-Time Parameter Estimation in the Frequency Domain
Morelli, Eugene A.; [1999]; 11 pp.; In English
Report No.(s): AIAA Paper 99-4043; Copyright; Avail: CASI; A03, Hardcopy

A method for real-time estimation of parameters in a linear dynamic state space model was developed and studied. The application is aircraft dynamic model parameter estimation from measured data in flight for indirect adaptive or reconfigurable control. Equation error in the frequency domain was used with a recursive Fourier transform for the real-time data analysis. Linear and nonlinear simulation examples and flight test data from the F-18 High Alpha Research Vehicle HARV) were used to demonstrate that the technique produces accurate model parameter estimates with appropriate error bounds. Parameter estimates converged in less than 1 cycle of the dominant dynamic mode natural frequencies, using control surface inputs measured in flight during ordinary piloted maneuvers. The real-time parameter estimation method has low computational requirements, and could be implemented aboard an aircraft in real time.
Author
Real Time Operation; Dynamic Models; Dynamic Response; Errors; Fourier Transformation; Research Vehicles

20040087111 NASA Langley Research Center, Hampton, VA, USA
Developments in Human Centered Cueing Algorithms for Control of Flight Simulator Motion Systems
Houck, Jacob A.; Telban, Robert J.; Cardullo, Frank M.; [1997]; 11 pp.; In English
Report No.(s): AIAA Paper 99-4328; Copyright; Avail: CASI; A03, Hardcopy

The authors conducted further research with cueing algorithms for control of flight simulator motion systems. A variation of the so-called optimal algorithm was formulated using simulated aircraft angular velocity input as a basis. Models of the human vestibular sensation system, i.e. the semicircular canals and otoliths, are incorporated within the algorithm. Comparisons of angular velocity cueing responses showed a significant improvement over a formulation using angular acceleration input. Results also compared favorably with the coordinated adaptive washout algorithm, yielding similar results for angular velocity cues while eliminating false cues and reducing the tilt rate for longitudinal cues. These results were confirmed in piloted tests on the current motion system at NASA-Langley, the Visual Motion Simulator (VMS). Proposed future developments by the authors in cueing algorithms are revealed. The new motion system, the Cockpit Motion Facility (CMF), where the final evaluation of the cueing algorithms will be conducted, is also described.
Author
Motion Simulators; Flight Simulators; Algorithms

20040087116 NASA Ames Research Center, Moffett Field, CA, USA
Adjoint Formulation for an Embedded-Boundary Cartesian Method
Nemec, Marian; Aftosmis, Michael J.; Murman, Scott M.; Pulliam, Thomas H.; May 20, 2004; 11 pp.; In English; 43rd AIAA Aerospace Sciences Meeting, 10-13 Jan. 2005, Reno, NV, USA; Copyright; Avail: CASI; A03, Hardcopy

Many problems in aerodynamic design can be characterized by smooth and convex objective functions. This motivates the use of gradient-based algorithms, particularly for problems with a large number of design variables, to efficiently determine optimal shapes and configurations that maximize aerodynamic performance. Accurate and efficient computation of the gradient, however, remains a challenging task. In optimization problems where the number of design variables dominates the number of objectives and flow- dependent constraints, the cost of gradient computations can be significantly reduced by the use of the adjoint method. The problem of aerodynamic optimization using the adjoint method has been analyzed and validated for both structured and unstructured grids. The method has been applied to design problems governed by the potential, Euler, and Navier-Stokes equations and can be subdivided into the continuous and discrete formulations. Giles and Pierce provide a detailed review of both approaches. Most implementations rely on grid-perturbation or mapping procedures during the gradient computation that explicitly couple changes in the surface shape to the volume grid. The solution of the adjoint equation is usually accomplished using the same scheme that solves the governing flow equations. Examples of such code

reuse include multistage Runge-Kutta schemes coupled with multigrid, approximate-factorization, line-implicit Gauss-Seidel, and also preconditioned GMRES. The development of the adjoint method for aerodynamic optimization problems on Cartesian grids has been limited. In contrast to implementations on structured and unstructured grids, Cartesian grid methods decouple the surface discretization from the volume grid. This feature makes Cartesian methods well suited for the automated analysis of complex geometry problems, and consequently a promising approach to aerodynamic optimization. Melvin e t al. developed an adjoint formulation for the TRANAIR code, which is based on the full-potential equation with viscous corrections. More recently, Dadone and Grossman presented an adjoint formulation for the Euler equations. In both approaches, a boundary condition is introduced to approximate the effects of the evolving surface shape that results in accurate gradient computation.
Author
Aerodynamic Characteristics; Design Analysis; Unstructured Grids (Mathematics); Structured Grids (Mathematics); Boundary Conditions

20040090450 NASA Langley Research Center, Hampton, VA, USA
Diffusion Characteristics of Upwind Schemes on Unstructured Triangulations
Wood, William A.; Kleb, William L.; [1998]; 14 pp.; In English; 29th AIAA Fluid Dynamics Conference, 15-18 Jun. 1998, Albuquerque, NM, USA
Report No.(s): AIAA Paper 98-2443; Copyright; Avail: CASI; A03, Hardcopy

The diffusive characteristics of two upwind schemes, multi-dimensional fluctuation splitting and dimensionally-split finite volume, are compared for scalar advection-diffusion problems. Algorithms for the two schemes are developed for node-based data representation on median-dual meshes associated with unstructured triangulations in two spatial dimensions. Four model equations are considered: linear advection, non-linear advection, diffusion, and advection-diffusion. Modular coding is employed to isolate the effects of the two approaches for upwind flux evaluation, allowing for head-to-head accuracy and efficiency comparisons. Both the stability of compressive limiters and the amount of artificial diffusion generated by the schemes is found to be grid-orientation dependent, with the fluctuation splitting scheme producing less artificial diffusion than the dimensionally-split finite volume scheme. Convergence rates are compared for the combined advection-diffusion problem, with a speedup of 2-3 seen for fluctuation splitting versus finite volume when solved on the same mesh. However, accurate solutions to problems with small diffusion coefficients can be achieved on coarser meshes using fluctuation splitting rather than finite volume, so that when comparing convergence rates to reach a given accuracy, fluctuation splitting shows a 20-25 speedup over finite volume.
Author
Diffusion; Triangulation; Upwind Schemes (Mathematics); Finite Volume Method

20040090534 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA, USA
A Comparison of Approximation Modeling Techniques: Polynomial Versus Interpolating Models
Giunta, Anthony A.; Watson, Layne T.; [1998]; 13 pp.; In English
Contract(s)/Grant(s): NAG1-1562
Report No.(s): AIAA- Paper 98-4758; Copyright; Avail: CASI; A03, Hardcopy

Two methods of creating approximation models are compared through the calculation of the modeling accuracy on test problems involving one, five, and ten independent variables. Here, the test problems are representative of the modeling challenges typically encountered in realistic engineering optimization problems. The first approximation model is a quadratic polynomial created using the method of least squares. This type of polynomial model has seen considerable use in recent engineering optimization studies due to its computational simplicity and ease of use. However, quadratic polynomial models may be of limited accuracy when the response data to be modeled have multiple local extrema. The second approximation model employs an interpolation scheme known as kriging developed in the fields of spatial statistics and geostatistics. This class of interpolating model has the flexibility to model response data with multiple local extrema. However, this flexibility is obtained at an increase in computational expense and a decrease in ease of use. The intent of this study is to provide an initial exploration of the accuracy and modeling capabilities of these two approximation methods.
Author
Polynomials; Approximation; Models; Interpolation

20040090576 NASA Langley Research Center, Hampton, VA, USA
Model Refinement Using Eigensystem Assignment
Maghami, Pieman G.; [1998]; 12 pp.; In English
Report No.(s): AIAA Paper 98-4441; Copyright; Avail: CASI; A03, Hardcopy

This paper presented a novel approach for the refinement of finite-element-based analytical models of flexible structures is presented. The proposed approach models the possible refinements in the mass, damping, and stiffness matrices of the finite element model in the form of a constant gain feedback with acceleration, velocity, and displacement measurements, respectively. Once, the free elements of the structural matrices have been defined, the problem of model refinement reduces to obtaining position, velocity, and acceleration gain matrices, which reassign a desired subset of the eigenvalues of the model, along with partial mode shapes, from their baseline values to those obtained from system identification test data. A sequential procedure is used to assign one self-conjugate pair of closed-loop eigenvalues at each step using symmetric output feedback gain matrices, and the closed-loop eigenvectors are partially assigned, while ensuring that the eigenvalues assigned in the previous steps are not disturbed. The procedure can also impose that gain matrices be dissipative in order to guarantee the stability of the refined model. A numerical example, involving finite element model refinement for a structural testbed at NASA Langley (CSI Evolutionary Model) is presented to demonstrate the feasibility of the proposed approach.
Author
Mathematical Models; Eigenvalues; Finite Element Method; Flexible Spacecraft

20040090603 NASA Langley Research Center, Hampton, VA, USA
Bell-Curve Based Evolutionary Optimization Algorithm
Sobieszczanski-Sobieski, J.; Laba, K.; Kincaid, R.; [1998; 15 pp.; In English; 7th AIAA/USAF/NASA/ISSMO Symposium on Multidisciplinary Analysis and Optimization, 2-4 Sep. 1998, Saint Louis, MI, USA
Report No.(s): AIAA Paper 98-4971; Copyright; Avail: CASI; A03, Hardcopy

The paper presents an optimization algorithm that falls in the category of genetic, or evolutionary algorithms. While the bit exchange is the basis of most of the Genetic Algorithms (GA) in research and applications in America, some alternatives, also in the category of evolutionary algorithms, but use a direct, geometrical approach have gained popularity in Europe and Asia. The Bell-Curve Based Evolutionary Algorithm (BCB) is in this alternative category and is distinguished by the use of a combination of n-dimensional geometry and the normal distribution, the bell-curve, in the generation of the offspring. The tool for creating a child is a geometrical construct comprising a line connecting two parents and a weighted point on that line. The point that defines the child deviates from the weighted point in two directions: parallel and orthogonal to the connecting line, the deviation in each direction obeying a probabilistic distribution. Tests showed satisfactory performance of BCB. The principal advantage of BCB is its controllability via the normal distribution parameters and the geometrical construct variables.
Author
Genetic Algorithms; Controllability; Normal Density Functions

20040090605 NASA Langley Research Center, Hampton, VA, USA
Aerodynamic Design Optimization on Unstructured Meshes Using the Navier-Stokes Equations
Nielsen, Eric J.; Anderson, W. Kyle; [1998]; 13 pp.; In English
Report No.(s): AIAA Paper 98-4809; Copyright; Avail: CASI; A03, Hardcopy

A discrete adjoint method is developed and demonstrated for aerodynamic design optimization on unstructured grids. The governing equations are the three-dimensional Reynolds-averaged Navier-Stokes equations coupled with a one-equation turbulence model. A discussion of the numerical implementation of the flow and adjoint equations is presented. Both compressible and incompressible solvers are differentiated and the accuracy of the sensitivity derivatives is verified by comparing with gradients obtained using finite differences. Several simplifying approximations to the complete linearization of the residual are also presented, and the resulting accuracy of the derivatives is examined. Demonstration optimizations for both compressible and incompressible flows are given.
Author
Aerodynamics; Design Optimization; Unstructured Grids (Mathematics); Turbulence Models; Mathematical Models

20040095299 NASA Langley Research Center, Hampton, VA, USA
Initial Results of an MDO Method Evaluation Study
Alexandrov, Natalia M.; Kodiyalam, Srinivas; [1998]; 13 pp.; In English
Contract(s)/Grant(s): L-6317
Report No.(s): AIAA Paper 98-4884; Copyright; Avail: CASI; A03, Hardcopy

The NASA Langley MDO method evaluation study seeks to arrive at a set of guidelines for using promising MDO methods by accumulating and analyzing computational data for such methods. The data are collected by conducting a series

of re- producible experiments. In the first phase of the study, three MDO methods were implemented in the SIGHT: framework and used to solve a set of ten relatively simple problems. In this paper, we comment on the general considerations for conducting method evaluation studies and report some initial results obtained to date. In particular, although the results are not conclusive because of the small initial test set, other formulations, optimality conditions, and sensitivity of solutions to various perturbations. Optimization algorithms are used to solve a particular MDO formulation. It is then appropriate to speak of local convergence rates and of global convergence properties of an optimization algorithm applied to a specific formulation. An analogous distinction exists in the field of partial differential equations. On the one hand, equations are analyzed in terms of regularity, well-posedness, and the existence and unique- ness of solutions. On the other, one considers numerous algorithms for solving differential equations. The area of MDO methods studies MDO formulations combined with optimization algorithms, although at times the distinction is blurred. It is important to
Author
Algorithms; Data Acquisition; Computation; Perturbation

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STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20040086182 Air Univ., Maxwell AFB, AL
Air University Sampling and Surveying Handbook: Guidelines for Planning, Organizing, and Conducting Surveys
Jan. 1996; 98 pp.; In English
Report No.(s): AD-A424563; No Copyright; Avail: CASI; A05, Hardcopy

This handbook contains guidelines for planning, organizing, and conducting surveys. It should be useful to anyone embarking on a project requiring the gathering of data through the medium of the questionnaire. The text is designed to be easily readable, even for someone with a limited background on the subject.
DTIC
Air Sampling; Handbooks; Surveys

20040086191 Naval Postgraduate School, Monterey, CA
A Computational Study of the Effect of Cross Wind on the Flow of Fire Fighting Agent
Meyers, Alexandra; Jun. 2004; 85 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424588; No Copyright; Avail: CASI; A05, Hardcopy

This research will be used to evaluate the feasibility of robotically, or remote-controlled firefighting nozzles aboard air-capable ships. A numerical model was constructed and analyzed, using the program CPD-ACS, of a fire hose stream being deflected by the influence of a crosswind, tailwind, or headwind. The model is intended to predict the reach of the fire hose stream, indicate the distribution pattern, and estimate the volume of fire fighting agent available at the end of the stream. Preliminary results for a two fluid cross flow model have been obtained.
DTIC
Fire Extinguishers; Fire Fighting; Wind Direction; Wind Effects

20040086209 Naval Postgraduate School, Monterey, CA
Aggregate Models for Target Acquisition in Urban Terrain
Mlakar, Joseph A.; Jun. 2004; 154 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424637; No Copyright; Avail: CASI; A08, Hardcopy

High-resolution combat simulations that model urban combat currently use computationally expensive algorithms to represent urban target acquisition at the entity level. While this may be suitable for small-scale urban combat scenarios, simulation run time can become unacceptably long for larger scenarios. Consequently, there is a need for models that can lend insight into target acquisition in urban terrain for large-scale scenarios in an acceptable length of time. This research develops urban target acquisition models that can be substituted for existing physics-based or computationally expensive combat simulation algorithms and result in faster simulation run time with an acceptable loss of aggregate simulation accuracy. Specifically, this research explores the following: (1) the adaptability of probability of line of sight estimates to urban terrain; (2) how cumulative distribution functions can be used to model the outcomes when a set of sensors is employed against a set of targets; (3) the uses for Markov Chains and Event Graphs to model the transition of a target among acquisition states; and

(4) how a system of differential equations may be used to model the aggregate flow of targets from one acquisition state to another. (4 tables, 33 figures, 18 refs.)
DTIC
Aggregates; Combat; Line of Sight; Mathematical Models; Simulation; Stochastic Processes; Target Acquisition; Terrain; Warfare

20040086280 Naval Postgraduate School, Monterey, CA
Using Discrete Event Simulation to Assess Obstacle Location Accuracy in the REMUS Unmanned Underwater Vehicle
Allen, Timothy E.; Jun. 2004; 149 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424759; No Copyright; Avail: CASI; A07, Hardcopy

Navy personnel use the REMUS unmanned underwater vehicle to search for submerged objects. Navigation inaccuracies lead to errors in predicting the location of objects and thus result in increased search times for Explosive Ordnance Disposal (EOD) teams searching for the object post-mission. This thesis explores contributions to navigation inaccuracy using Discrete Event Simulation (DES) to model the vehicle's navigation system and operational performance. The DES produced for this thesis uses the JAVA- based Simkit package to simulate the navigation system in REMUS. The model considers factors affecting accuracy, such as compass error, the effect of current, transducer drop error, transducer positioning effects, and ping interval. Mines can be placed at specific locations or generated randomly. Three types of vehicles are considered in this thesis. First, a simple vehicle that navigates by Dead Reckoning is analyzed. Second, a more complex vehicle that navigates using Long- Baseline (LBL) is analyzed. Third, the vehicle is simulated to move through an area of interest in a sweeping pattern that is populated by 10 mines, each of which is randomly positioned. Data from the last vehicle are used to build three analytic models that the operator can use to improve performance. First, the probability of detection is modeled by a logit regression. Second, given that detection has occurred, the mean location offset is modeled by a linear regression. Third, the distribution of errors is shown to follow an exponential distribution. These three models enable operators to explore the impact of various inputs prior to programming the vehicle, thus allowing them to choose the best combination of vehicle parameters that minimize the offset error between the reported and actual locations. (18 tables, 33 figures, 17 refs.)
DTIC
Computerized Simulation; Navigation; Position (Location); Prediction Analysis Techniques; Simulation; Underwater Vehicles

20040086281 Naval Postgraduate School, Monterey, CA
An Exploratory Analysis of Village Search Operations
Aydin, Mehmet; Jun. 2004; 110 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424760; No Copyright; Avail: CASI; A06, Hardcopy

Following the cold war a new kind of threat emerged; terrorism became the most important threat used by individuals, organizations, and countries to reach their goals. Turkey has suffered from terrorism for years. In Turkey, the main logistic resources for the terrorist are the villages located in remote areas. A search operation is one of the techniques used to capture these terrorists. In this study, five village search operation scenarios are developed based on a previous study done for the New Zealand Army and the author's personal experiences. The agent-based model MANA (Map Aware Non-uniform Automata) is used to develop the scenarios, and state-of-the-art Near Orthogonal Latin Hypercube Designs are used to investigate the effects of 16 variables. Using a personal computer and the computational capabilities of supercomputers run by Mitre for the Marine Corps Warfighting Lab (MCWL), approximately 15,000 runs were completed. In comparing the five scenarios, the significant effects on the outcome of a possible skirmish in village search operations are the proficiency level of the soldiers, the employment of village guards, and the support of the local people for the terrorists. The results of this analysis suggest that the most important factor affecting Blue casualties is the initial speed and synchronization of the Blue search unit entering the village, and the most important factor affecting Red casualties is the Red Stealth. (3 tables, 26 figures, 23 refs.)
DTIC
Combat; Simulation

20040087092 QSS Group, Inc., Moffett Field, CA, USA, NASA Ames Research Center, Moffett Field, CA, USA
Combining Particle Filters and Consistency-Based Approaches for Monitoring and Diagnosis of Stochastic Hybrid Systems
Narasimhan, Sriram; Dearden, Richard; Benazera, Emmanuel; [2004]; 6 pp.; In English; 15th International Workshop on Principles of Diagnosis, 23-25 Jun. 2004, Carcassonne, France; No Copyright; Avail: CASI; A02, Hardcopy

Fault detection and isolation are critical tasks to ensure correct operation of systems. When we consider stochastic hybrid

systems, diagnosis algorithms need to track both the discrete mode and the continuous state of the system in the presence of noise. Deterministic techniques like Livingstone cannot deal with the stochasticity in the system and models. Conversely Bayesian belief update techniques such as particle filters may require many computational resources to get a good approximation of the true belief state. In this paper we propose a fault detection and isolation architecture for stochastic hybrid systems that combines look-ahead Rao-Blackwellized Particle Filters (RBPF) with the Livingstone 3 (L3) diagnosis engine. In this approach RBPF is used to track the nominal behavior, a novel n-step prediction scheme is used for fault detection and L3 is used to generate a set of candidates that are consistent with the discrepant observations which then continue to be tracked by the RBPF scheme.
Author
Fault Detection; Stochastic Processes; Systems Engineering; Kalman Filters; Mathematical Models; Hybrid Computers

20040095301 Defence Science and Technology Organisation, Edinburgh, Australia
Statistical Analysis of Northern Australian Land Backgrounds
Rosenberg, Luke; Wegener, Michael; July 2004; 121 pp.; In English
Report No.(s): DSTO-TR-1456; DODA-AR-99/133; Copyright; Avail: Other Sources

A substantial amount of work into the statistical analysis of both visual and infra-red imagery has been undertaken in the recent years at DSTO. This report is a summary of the results from the analysis of a trial held in Northern Australia in 1997. The first and second order statistics of land background infra-red pixel intensities were estimated and Gaussian histogram and power-law auto-covariance models were rigorously tested, before a stochastic simulation of the data was performed. As the simulation technique required Gaussian statistics, a point-wise non-linear transform was applied to those ensemble images with non-Gaussian histograms.
Author
Statistical Analysis; Australia; Covariance; Estimating; Histograms

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20040086168 Naval Postgraduate School, Monterey, CA
Development and Evaluation of an Automated Decision Aid for Rapid Re-Tasking of Air Strike Assets in Response to Time Sensitive Targets
Weaver, Paul R.; Jun. 2004; 135 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424532; No Copyright; Avail: CASI; A07, Hardcopy

This thesis addresses the problem of optimally re- assigning strike aircraft to targets in response to the emergence of 'pop-ups' or time-sensitive targets. The first part of this thesis develops an automated decision aid to rapidly revise the current air tasking order (ATO) so as to: maximize achievement of target destruction goals (weighted by target prionties) minimize attrition risk to employed assets and disrupt the current ATO as little as possible. The second part of the thesis develops a detailed test and evaluation plan to conduct a comparison of two competing automated decision aids and the current manual reassignment methods. Critical operational issues measures of effectiveness and measures of performance were developed to fully evaluate operational performance. The time-sensitive-targeting decision aid was tested and validated during major air strike live exercises at Marine Aviation Weapons and Tactics Squadron One. Careful measurements comparing the re-taskings recommended by the decision aid against actual decisions demonstrated that in every case the model's solutions were of better or equal quality maximized combat asset utilization and were achieved significantly faster.
DTIC
Decision Support Systems; Sensitivity; Targets

20040086773 NASA Langley Research Center, Hampton, VA, USA
Design of Neural Networks for Fast Convergence and Accuracy: Dynamics and Control
Maghami, Peiman G.; Sparks, Dean W., Jr.; [1997]; 33 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

A procedure for the design and training of artificial neural networks, used for rapid and efficient controls and dynamics design and analysis for flexible space systems, has been developed. Artificial neural networks are employed, such that once properly trained, they provide a means of evaluating the impact of design changes rapidly. Specifically, two-layer feedforward neural networks are designed to approximate the functional relationship between the component/spacecraft design changes and

measures of its performance or nonlinear dynamics of the system/components. A training algorithm, based on statistical sampling theory, is presented, which guarantees that the trained networks provide a designer-specified degree of accuracy in mapping the functional relationship. Within each iteration of this statistical-based algorithm, a sequential design algorithm is used for the design and training of the feedforward network to provide rapid convergence to the network goals. Here, at each sequence a new network is trained to minimize the error of previous network. The proposed method should work for applications wherein an arbitrary large source of training data can be generated. Two numerical examples are performed on a spacecraft application in order to demonstrate the feasibility of the proposed approach.
Author
Neural Nets; Optimization; Design Analysis

20040086774 NASA Langley Research Center, Hampton, VA, USA
Multidisciplinary High-Fidelity Analysis and Optimization of Aerospace Vehicles, Part 2, Preliminary Results
Walsh, J. L.; Weston, R. P.; Samareh, J. A.; Mason, B. H.; Green, L. L.; Biedron, R. T.; [2000]; 22 pp.; In English; 38th Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2000, Reno, NV, USA
Report No.(s): AIAA Paper 2000-0419; Copyright; Avail: CASI; A03, Hardcopy

An objective of the High Performance Computing and Communication Program at the NASA Langley Research Center is to demonstrate multidisciplinary shape and sizing optimization of a complete aerospace vehicle configuration by using high-fidelity finite-element structural analysis and computational fluid dynamics aerodynamic analysis in a distributed, heterogeneous computing environment that includes high performance parallel computing. A software system has been designed and implemented to integrate a set of existing discipline analysis codes, some of them computationally intensive, into a distributed computational environment for the design of a high-speed civil transport configuration. The paper describes both the preliminary results from implementing and validating the multidisciplinary analysis and the results from an aerodynamic optimization. The discipline codes are integrated by using the Java programming language and a Common Object Request Broker Architecture compliant software product. A companion paper describes the formulation of the multidisciplinary analysis and optimization system.
Author
Design Analysis; Shape Optimization; Multidisciplinary Design Optimization; Aerodynamic Configurations

20040086785 NASA Ames Research Center, Moffett Field, CA, USA
Dynamic Programming for Structured Continuous Markov Decision Problems
Dearden, Richard; Meuleau, Nicholas; Washington, Richard; Feng, Zhengzhu; [2004]; 8 pp.; In English; Twentieth Conference on Uncertainty in Artificial Intelligene (UAI-04), 7-11 Jul. 2004, Banff, Canada
Contract(s)/Grant(s): NSF IIS-02-19606; NCC2-1311; No Copyright; Avail: CASI; A02, Hardcopy

We describe an approach for exploiting structure in Markov Decision Processes with continuous state variables. At each step of the dynamic programming, the state space is dynamically partitioned into regions where the value function is the same throughout the region. We first describe the algorithm for piecewise constant representations. We then extend it to piecewise linear representations, using techniques from POMDPs to represent and reason about linear surfaces efficiently. We show that for complex, structured problems, our approach exploits the natural structure so that optimal solutions can be computed efficiently.
Author
Dynamic Programming; Markov Processes; Decision Theory

20040086903 Stanford Univ., Stanford, CA, USA
Modeling Engineering Design Thinking and Performance as a Question-Driven Process
Eris, Ozgur; Innovative Design of Complex Engineering Systems; July 2004, pp. 193-221; In English; See also 20040086893; No Copyright; Avail: CASI; A03, Hardcopy

Design teams transform product requirements into product specifications. Traditionally, as a performance dimension, engineering design teams are trained to focus on the product. They identify and monitor key performance variables associated with the product. This is the basis for iteration in the design process. One way of accounting for the performance dimension associated with the design process is to consider the human variables in design activity. By ‘human,’ I am referring to the people who are directly involved in design activity and make up the design team, and not to the users. I designed a

quasi-controlled laboratory experiment, which required the operationalization (formalization) of three fundamental aspects of question asking: 1) Definition; 2) Timing; 3) Nature.
Derived from text
Engineers; Teams; Problem Solving

20040090516 NASA Langley Research Center, Hampton, VA, USA
Parameterization of Model Validating Sets for Uncertainty Bound Optimizations
Lim, K. B.; Giesy, D. P.; [1998]; 11 pp.; In English
Report No.(s): AIAA Paper 98-4135; Copyright; Avail: CASI; A03, Hardcopy

Given experimental data and a priori assumptions on nominal model and a linear fractional transformation uncertainty structure, feasible conditions for model validation is given. All unknown but bounded exogenous inputs are assumed to occur at the plant outputs. With the satisfaction of the feasible conditions for model validation, it is shown that a parameterization of all model validating sets of plant models is possible. The new parameterization can be used as a basis for the development of a systematic way to construct model validating uncertainty models which have specific linear fractional transformation structure for use in robust control design and analysis. The proposed feasible condition (existence) test and the parameterization is computationally attractive as compared to similar tests currently available.
Author
Optimization; Parameterization; Mathematical Models; Algorithms; Robustness (Mathematics)

20040090598 NASA Langley Research Center, Hampton, VA, USA
Framework Requirements for MDO Application Development
Salas, A. O.; Townsend, J. C.; [1998]; 11 pp.; In English
Report No.(s): AIAA Paper 98-4740; Copyright; Avail: CASI; A03, Hardcopy

Frameworks or problem solving environments that support application development form an active area of research. The Multidisciplinary Optimization Branch at NASA Langley Research Center is investigating frameworks for supporting multidisciplinary analysis and optimization research. The Branch has generated a list of framework requirements, based on the experience gained from the Framework for Interdisciplinary Design Optimization project and the information acquired during a framework evaluation process. In this study, four existing frameworks are examined against these requirements. The results of this examination suggest several topics for further framework research.
Author
Multidisciplinary Design Optimization; Aerospace Systems; Architecture (Computers); Computer Systems Design

67
THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

20040086254 Naval Postgraduate School, Monterey, CA
Prediction of Instantaneous Currents in San Diego Bay for Naval Applications
Armstrong, Albert E.; Jun. 2004; 72 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424704; No Copyright; Avail: CASI; A04, Hardcopy

Naval operations are highly dependent upon environmental conditions that can either adversely affect successful completion or hinder the safety of personnel. Each warfare community has defined environmental thresholds and operating limits that restrict the execution of any intended maneuver. As the warfare environment continues to shift from open ocean to the littoral, environmental prediction and modeling efforts of shallow water surroundings need to be developed to support these operations. A hydrodynamic model, Water Quality Management and Analysis Package (WQMAP), has been developed by Applied Sciences Associates, Inc. to provide accurate littoral environmental prediction. WQMAP consists of a boundary-fitted coordinate grid creation module, a 3D hydrodynamics model, and a water quality or pollutant transport model. WQMAP is one of several hydrodynamic models used by the Naval Oceanographic Office (NAVOCEANO) to predict currents and water elevations in littoral regions. WQMAP differs from other Navy operational current prediction models, such as Wave Watch 3 and the Navy Layered Ocean Model. Both of these models forecast for large scale or global regions and do not provide output for inner littoral bays and estuaries. A finer resolution model designed within specific bays is required to support mine warfare and diver operations within these locations. Implementations of shallow water hydrodynamic models in foreign waters are usually data-starved for model forcing and validation. In a series of studies, NAVOCEANO intends to

model various bays within the continental USA, where sufficient data exist, to study the sensitivity of lack of data on model results. This study will utilize WQMAP to design a hydrodynamic model of San Diego Bay to predict currents. This will allow researchers to investigate the impact of grid resolution on model results, and to provide proper current predictions for Fleet training and operations. (4 tables, 24 figures, 6 refs.) 7
DTIC
Hydrodynamics; Ocean Currents; Prediction Analysis Techniques; Regions; Shallow Water

20040086271 Naval Postgraduate School, Monterey, CA
Space Charge Limited Emission Studies Using Coulomb's Law
Carr, Christopher G.; Jun. 2004; 43 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424738; No Copyright; Avail: CASI; A03, Hardcopy

Child and Langmuir introduced a solution to space charge limited emission in an infinite area planar diode. The solution follows from starting with Poisson's equation, and requires solving a non-linear differential equation. This approach can also be applied to cylindrical and spherical geometries, but only for one-dimensional cases. By approaching the problem from Coulomb's law and applying the effect of an assumed charge distribution, it is possible to solve for space charge limited emission without solving a non-linear differential equation, and to limit the emission area to two- dimensional geometries. Using a Mathcad worksheet to evaluate Coulomb's law, it is possible to show correlation between the solution derived by Child and Langmuir and Coulomb's law.
DTIC
Differential Equations; Electron Emission; Space Charge

20040086738 NASA Langley Research Center, Hampton, VA, USA
Parameterization of Model Validating Sets for Uncertainty Bound Optimizations
Lim, K. B.; Giesy, D. P.; [2000]; 37 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Given measurement data, a nominal model and a linear fractional transformation uncertainty structure with an allowance on unknown but bounded exogenous disturbances, easily computable tests for the existence of a model validating uncertainty set are given. Under mild conditions, these tests are necessary and sufficient for the case of complex, nonrepeated, block-diagonal structure. For the more general case which includes repeated and/or real scalar uncertainties, the tests are only necessary but become sufficient if a collinearity condition is also satisfied. With the satisfaction of these tests, it is shown that a parameterization of all model validating sets of plant models is possible. The new parameterization is used as a basis for a systematic way to construct or perform uncertainty tradeoff with model validating uncertainty sets which have specific linear fractional transformation structure for use in robust control design and analysis. An illustrative example which includes a comparison of candidate model validating sets is given.
Author
Parameterization; Mathematical Models; Set Theory; Uncertain Systems

20040086925 NASA Ames Research Center, Moffett Field, CA, USA
Measuring Questions: Relevance and its Relation to Entropy
Knuth, Kevin H.; [2004]; 1 pp.; In English; MaxEnt 2004, 25-30 Jul. 2004, Garching, Germany; No Copyright; Avail: Other Sources; Abstract Only

The Boolean lattice of logical statements induces the free distributive lattice of questions. Inclusion on this lattice is based on whether one question answers another. Generalizing the zeta function of the question lattice leads to a valuation called relevance or bearing, which is a measure of the degree to which one question answers another. Richard Cox conjectured that this degree can be expressed as a generalized entropy. With the assistance of yet another important result from Janos Acz6l, I show that this is indeed the case; and that the resulting inquiry calculus is a natural generalization of information theory. This approach provides a new perspective of the Principle of Maximum Entropy.
Author
Boolean Algebra; Lattices (Mathematics); Mathematical Logic; Maximum Entropy Method

PHYSICS (GENERAL)

Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics. For specific areas of physics see *categories 71 through 77*. For related instrumentation see *35 Instrumentation and Photography*; for geophysics, astrophysics, or solar physics see *46 Geophysics, 90 Astrophysics*, or *92 Solar Physics*.

20040086169 Naval Postgraduate School, Monterey, CA

A Three-Phase Hybrid DC-AC Inverter System Utilizing Hysteresis Control

White, Terence H.; Jun. 2004; 93 pp.; In English; Original contains color illustrations

Report No.(s): AD-A424533; No Copyright; Avail: CASI; A05, Hardcopy

The naval vessels of the future will require lighter more compact and more versatile power electronics systems. With the advent of the DC Zonal Electrical Distribution System more innovative approaches to the conversion of the dc bus power to ac power for motor drives will enhance the efficiency and warfighting capability of tomorrow's ships. This thesis explored the concept of a hybrid dc-ac power converter that combines a hysteresis controlled inverter with a six-step bulk inverter. A six-step bulk inverter was built from discrete components and tested in simulation and hardware. The two inverters were connected in parallel to provide a high-fidelity current source for a three- phase load. The addition of the hysteresis inverter to the bulk inverter added a closed current loop for more robust control and improved the quality of the output load current.

DTIC

Alternating Current; Hysteresis; Inverters

20040086264 Naval Postgraduate School, Monterey, CA

Elastoplastic Analysis for Severe Underwater Explosions Using Dynamic Finite Element Modeling

Lau, Sunny G.; Jun. 2004; 108 pp.; In English; Original contains color illustrations

Report No.(s): AD-A424720; No Copyright; Avail: CASI; A06, Hardcopy

Ship shock testing is a live fire testing and evaluation process designed to determine the vulnerabilities of a surface combatant. Such testing is inherently dangerous and as a result shock simulation models were created to provide an alternative. This study models dynamic elastoplastic response through material property changes. Using a ship-like box model followed by a two-thirds design shot model of the USS WINSTON CHURCHILL (DDG-81) elastoplastic response was compared with prior elastic studies. A brief study was also conducted for the full design shot since elastoplastic shock model simulations makes it possible to predict up to and beyond a ship's structural limit.

DTIC

Elastoplasticity; Finite Element Method; Mathematical Models; Ships; Underwater Explosions

20040086467 Washington Univ., Seattle, WA

Electric Field Floats in the North Atlantic Current: Validation and Observations

Szuts, Zoltan B.; Jun. 2004; 89 pp.; In English; Original contains color illustrations

Report No.(s): AD-A424755; APL-UW-TR-0405; No Copyright; Avail: CASI; A05, Hardcopy

Electric field floats were designed and built to measure depth-averaged velocity. They were made from commercial RAFOS floats modified to make horizontal electric field measurements through the addition of two pairs of electrodes, electrode arms, rotation vanes, a compass, amplifiers, and a microprocessor. The added second system coordinated its activities with the RAFOS system by an optical serial connection.

DTIC

Atlantic Ocean; Electric Fields; Floats; Ocean Currents

20040086589 Universiteit Twente, Enschede, Netherlands

Physics of Photonic Crystals: Of Dreams and Nightmares

Vos, Willem L.; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 19; In English; See also 20040086587; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We present first evidence that photonic crystals control emission rates of embedded light sources. We analyze intrinsic disorder in 2D and 3D crystals and conclude that applications, especially integrated circuits, have a dim future.

Author

Crystals; Photons; Physical Factors; Light Emission

20040086606 Istituto Nazionale per la Fisica della Materia, Milan, Italy

GRADFLEX: Fluctuations in Microgravity

Vailati, A.; Cerbino, R.; Mazzoni, S.; Giglio, M.; Nikolaenko, G.; Cannell, D. S.; Meyer, W. V.; Smart, A. E.; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 50-51; In English; See also 20040086587; No Copyright; Avail: CASI; A01, Hardcopy

We present the results of experimental investigations of gradient driven fluctuations induced in a liquid mixture with a concentration gradient and in a single-component fluid with a temperature gradient. We also describe the experimental apparatus being developed to carry out similar measurement under microgravity conditions.

Author

Gradients; Microgravity; Temperature Gradients; Liquids

20040086620 Istituto Nazionale per la Fisica della Materia, Milan, Italy

Dynamics of Gradient Driven Fluctuations in a Free Diffusion Process

Croccolo, Fabrizio; Brogioli, Doriano; Vailati, Alberto; Cannell, David S.; Giglio, Marzio; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 52-53; In English; See also 20040086587; No Copyright; Avail: CASI; A01, Hardcopy

We measure fluctuations' dynamics in a free diffusion process applying a new processing to Shadowgraph images to get temporal correlation functions. These functions appeared as decaying exponentials with characteristic time t depending on q vector.

Author

Diffusion; Gradients; Variations; Hydrodynamics

20040086668 Princeton Univ., NJ

Theory and Observations of High Frequency Alfven Eigenmodes in Low Aspect Ratio Plasma

Gorelenkov, N. N.; Fredrickson, E.; Bwlova, E.; Cheng, C. Z.; Gates, D.; Jun. 2003; In English

Report No.(s): DE2003-814692; PPPL-3828; No Copyright; Avail: National Technical Information Service (NTIS)

New observations of sub-cyclotron frequency instability in low aspect ratio plasma in National Spherical Torus Experiments (NSTX) are reported. The frequencies of observed instabilities correlate with the characteristic Alfven velocity of the plasma. A theory of localized Compressional Alfven Eigenmodes (CAE) and Global shear Alfven Eigenmodes (GAE) in low aspect ratio plasma is presented to explain the observed high frequency instabilities. CAE's/GAE's are driven by the velocity space gradient of energetic super-Alfvenic beam ions via Doppler shifted cyclotron resonances. One of the main damping mechanisms of GAE's, the continuum damping, is treated perturbatively within the framework of ideal MHD. Properties of these cyclotron instabilities ions are presented

NTIS

Cyclotron Frequency; Stability; Plasmas (Physics); Magnetohydrodynamic Waves; Velocity Distribution

20040086669 Princeton Univ., NJ

Energetic Ion Behavior in the National Spherical Torus Experiment

Medley, S. S.; Bell, R. E.; Fredrickson, E. D.; Jun. 2003; In English

Report No.(s): DE2003-814691; PPPL-3827; No Copyright; Avail: National Technical Information Service (NTIS)

The National Spherical Torus Experiment (NSTX) is a low aspect ratio (R/a approximately equal to 1.3) device with auxiliary heating from neutral beam injection (NBI) and high harmonic fast wave (HHFW) heating. Typical NSTX parameters are R(sub)0= 85 cm, a= 67 cm, I(sub)p less than or equal to 1.5 MA, B(sub)T= 0.3-0.6 T. Three co-directed deuterium neutral beam sources have injected P(sub)NB less than or equal to 6.2 MW at energies E(sub)b less than or equal to 100 keV. HHFW heating has delivered up to P(sub)RF approximately equal to 6 MW to deuterium and helium plasmas.

NTIS

Beam Injection; Deuterium Plasma; Helium Plasma; Neutral Beams

20040086670 Princeton Univ., NJ

Zonal Flow Dynamics and Size-Scaling of Anomalous Transport

Chen, L.; White, R. B.; Zonca, F.; 2003; In English

Report No.(s): DE2003-814729; PPPL-3847; No Copyright; Avail: National Technical Information Service (NTIS)

Nonlinear equations for the slow space-time evolution of the radial drift wave envelope and zonal flow amplitude have

been self-consistently derived for a model nonuniform tokamak equilibrium within the coherent 4-wave drift wave-zonal flow modulation interaction model of Chen, Lin, and White(Phys. Plasmas 7 (2000) 3129). Solutions clearly demonstrate turbulence spreading due to nonlinearly enhanced dispersiveness and, consequently, the device-size dependence of the saturated wave intensities and transport coefficients.
NTIS
Tokamak Devices; Turbulence; Transport Theory

20040086671 Princeton Univ., NJ
Diagnostic Development for ST Plasmas on NSTX
Johnson, D.; Jun. 2003; In English
Report No.(s): DE2003-814679; PPPL-3822; No Copyright; Avail: National Technical Information Service (NTIS)

Spherical tokamaks (STs) have much lower aspect ratio (a/R) and lower toroidal magnetic field, relative to tokamaks and stellarators. This paper will highlight some of the challenges and opportunities these features pose in the diagnosis of ST plasmas on the National Spherical Torus Experiment (NSTX), and discuss some of the corresponding diagnostic development that is underway. The low aspect ratio necessitates a small center stack, with tight space constraints and large thermal excursions, complicating the design of magnetic sensors in this region. The toroidal magnetic field on NSTX is 0.6 T, making it impossible to use ECE as a good monitor of electron temperature. A promising new development for diagnosing electron temperature is electron Bernstein wave (EBW) radiometry, which is currently being pursued on NSTX. A new high-resolution charge exchange recombination spectroscopy system is being installed. Since non-inductive current initiation and sustainment are top-level NSTX research goals, measurements of the current profile J(R) are essential to many planned experiments. On NSTX several modifications are planned to adapt the MSE technique to lower field, and two novel MSE systems are being prototyped. Several high speed 2-D imaging techniques are being developed, for viewing both visible and x-ray emission. The toroidal field is comparable to the poloidal field at the outside plasma edge, producing a large field pitch (\g50DG) at the outer midplane. The large shear in pitch angle makes some fluctuation diagnostics like beam emission spectroscopy very difficult, while providing a means of achieving spatial localization for microwave scattering investigations of high-k turbulence, which are predicted to be virulent for NSTX plasmas. A brief description of several of these techniques will be given in the context of the current NSTX diagnostic set.
NTIS
Tokamak Devices; Aspect Ratio; Plasmas (Physics)

20040086672 Princeton Univ., NJ
Gabor Wave Packet Method to Solve Plasma Wave Equations
Pletzer, A.; Phillips, C. K.; Smithe, D. N.; Jul. 2003; In English
Report No.(s): DE2003-814689; PPL-3825; No Copyright; Avail: National Technical Information Service (NTIS)

A numerical method for solving plasma wave equations arising in the context of mode conversion between the fast magnetosonic and the slow (e.g. ion Bernstein) wave is presented. The numerical algorithm relies on the expansion of the solution in Gaussian wave packets known as Gabor functions, which have good resolution properties in both real and Fourier space. The wave packets are ideally suited to capture both the large and small wavelength features that characterize mode conversion problems. The accuracy of the scheme is compared with a standard finite element approach.
NTIS
Plasma Waves; Numerical Analysis; Algorithms

20040086683 NASA Langley Research Center, Hampton, VA, USA
Polarization Stability of Amorphous Piezoelectric Polyimides
Park, C.; Ounaies, Z.; Su, J.; Smith, J. G., Jr.; Harrison, J. S.; [2000]; 6 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

Amorphous polyimides containing polar functional groups have been synthesized and investigated for potential use as high temperature piezoelectric sensors. The thermal stability of the piezoelectric effect of one polyimide was evaluated as a function of various curing and poling conditions under dynamic and static thermal stimuli. First, the polymer samples were thermally cycled under strain by systematically increasing the maximum temperature from 50 C to 200 C while the piezoelectric strain coefficient was being measured. Second, the samples were isothermally aged at an elevated temperature in air, and the isothermal decay of the remanent polarization was measured at room temperature as a function of time. Both

conventional and corona poling methods were evaluated. This material exhibited good thermal stability of the piezoelectric properties up to 100 C.
Author
Polarization Characteristics; Amorphous Materials; Piezoelectricity; Polyimides

20040087273 California Univ., Berkeley, CA, Stanford Univ., Stanford, CA, USA
Orientifolds, RG Flows, and Closed String Tachyons
Kachru, S.; Kumar, J.; Silverstein, E.; 1999; 20 pp.; In English
Report No.(s): DE2004-10108; LBNL-43634; No Copyright; Avail: Department of Energy Information Bridge

We discuss the fate of certain tachyonic closed string theories from two perspectives. In both cases our approach involves studying directly configurations with finite negative tree-level cosmological constant. Closed string analogues of orientifolds, which carry negative tension, are argued to represent the minima of the tachyon potential in some cases. In other cases, we make use of the fact, noted in the early string theory literature, that strings can propagate on spaces of subcritical dimension at the expense of introducing a tree-level cosmological constant. The form of the tachyon vertex operator in these cases makes it clear that a subcritical-dimension theory results from tachyon condensation. Using results of Kutasov, we argue that in some Scherk-Schwarz models, for finely-tuned tachyon condensates, a minimal model CFT times a subcritical dimension theory results. In some instances, these two sets of ideas may be related by duality.
NTIS
Tachyons; Cosmology; String Theory

20040087282 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA
Physics Potential of the JLab Upgrade
Chen, J. P.; 2003; 8 pp.; In English
Report No.(s): DE2004-822198; No Copyright; Avail: Department of Energy Information Bridge

The planned upgrade of the Jefferson Lab energy to 12 GeV will greatly expand the capability of the facility to make profound contributions to the study of nuclear and nucleon structure, and the strong interaction. In particular, it will allow direct exploration of the quark-gluon structure of hadrons and nuclei, and of quark confinement. The physics potential is illustrated with selected examples. The instrumentation under design to carry out the research program is also presented. The plan for an upgrade beyond 12 GeV is briefly discussed.
NTIS
Confinement; Hadrons; Nucleons

20040087284 Stanford Linear Accelerator Center, Stanford, CA, USA
Probing Strong Electroweak Symmetry Breaking in W(sup +)W(Sup -) --\g tau tua Overline
Morales, E. R.; Peskin, M. E.; 1999; 12 pp.; In English
Report No.(s): DE2004-12486; SLAC-PUB-8251; No Copyright; Avail: Department of Energy Information Bridge

We study the process W(sup+)W(sup -)(yields) t(bar t) in several models of strong interaction electroweak symmetry breaking. We calculate the signals that can be expected by observing the reaction e(sup+)e(sup -)(yields) v(bar v)t(bar t) at an e(sup+)e(sup -) linear collider with 1.5 TeV center of mass energy. We also discuss how the lowest-lying resonances predicted by these models could be identified using top polarization observables
NTIS
Broken Symmetry; Polarization; Electroweak Interactions (Field Theory)

20040087291 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA
Nucleon Electromagnetic Form Factors: Free Space and Medium Modifications
Melnitchouk, W.; Oct. 2003; In English
Report No.(s): DE2004-822201; No Copyright; Avail: National Technical Information Service (NTIS)

We review recent developments in the study of electromagnetic form factors of the nucleon, both in free space and in the nuclear medium. For the free nucleon case, we discuss the ratio of electric to magnetic proton form factors, and the influence of two-photon exchange on the form factor extraction. For the bound nucleon, we examine the implications of the small but non-zero modification of proton form factors in the nuclear medium suggested by recent data on polarized proton knockout

reactions off He-4, and discuss constraints which it could place on models of the nuclear EMC effect.
NTIS
Electromagnetic Compatibility; Form Factors; Nucleons

20040087296 Fermi National Accelerator Lab., Batavia, IL, USA
Modified Post Damping Ring Bunch Compressor Beamline for the TESLA Linear Collider
Piot, P.; Decking, W.; Mar. 2004; 12 pp.; In English
Report No.(s): DE2004-822226; FERMILAB-TM-2235; No Copyright; Avail: Department of Energy Information Bridge

We propose a modified bunch compressor beamline, downstream of the damping ring, for the TESLA linear collider. This modified beamline uses a third harmonic radio-frequency section based on the 3.9 GHz superconducting cavity under development at Fermilab. In our design the beam deceleration is about (approx) 50 MeV instead of (approx) 450 MeV in the original design proposed.
NTIS
Deceleration; Compressors; Damping

20040087298 Stanford Linear Accelerator Center, Stanford, CA, USA
Can Lepton Flavor Violating Interactions Explain the LSND Results
Bergmann, S.; Grossman, Y.; 2004; 26 pp.; In English
Report No.(s): DE2004-9924; SLAC-PUB-7950; No Copyright; Avail: Department of Energy Information Bridge

If the atmospheric and the solar neutrino problem are both explained by neutrino oscillations, and if there are only three light neutrinos, then all mass-squared differences between the neutrinos are known. In such a case, existing terrestrial neutrino oscillation experiments cannot be significantly affected by neutrino oscillations, but, in principle there could be an anomaly in the neutrino flux due to new neutrino interactions. We discuss how a non-standard muon decay mu(sup+) --\g e(sup+)anti-nu(sub e)nu(sub l) would modify the neutrino production processes of these experiments. Since SU(2)(sub L) violation is small for New Physics above the weak scale one can use related flavor-violating charged lepton processes to constrain these decays in a model independent way. We show that the upper bounds on mu --\g 3e, muonium-antimuonium conversion and tau --\g mu e e rule out any observable effect for the present experiments due to mu(sup+) --\g e(sup+) n u(sub e)nu(sub l) for l= e, mu, tau respectively. Applying similar arguments to flavor-changing semi-leptonic reactions we exclude the possibility that the 'oscillation signals' observed at LSND are due to flavor-changing interactions that conserve total lepton number.
NTIS
Leptons; Oscillations; Neutrinos

20040087301 Stanford Linear Accelerator Center, Stanford, CA, USA
Recent Developments on Strained Photocathode Research
Maruyama, T.; Clendenin, J. E.; Garwin, E. L.; Kirby, R. E.; 1998; 14 pp.; In English
Report No.(s): DE2004-9929; SLAC-PUB-7960; No Copyright; Avail: Department of Energy Information Bridge

For the past five years, strained GaAs photocathodes have been used for the SLAC polarized electron source producing electron beams having a spin polarization of 78% (85%) for high (low) current operation. Photocathode research has been continuously conducted to understand the cathode characteristics and to improve performances. This paper describes the recent developments in the strained photocathode research at SLAC.
NTIS
Photocathodes; Electron Sources

20040087308 Stanford Linear Accelerator Center, Stanford, CA, USA
Possible Origin of Fermion Chirality and Gut Structure from Extra Dimensions
de Teramond, G. F.; 1999; 20 pp.; In English
Report No.(s): DE2004-9933; SLAC-PUB-7964; No Copyright; Avail: Department of Energy Information Bridge

The fundamental chiral nature of the observed quarks and leptons and the emergence of the gauge group itself are most puzzling aspects of the standard model. Starting from general considerations of topological properties of gauge field configurations in higher space- time dimensions, it is shown that the existence of non-trivial structures in ten dimensions would determine a class of models corresponding to a grand unified GUT structure with complex fermion representations with respect to SU(3)(sub c) x SU(2)(sub L) x U(1)(sub y). The discussion is carried out within the framework of string theories

with characteristic energy scales below the Planck mass. Avoidance of topological obstructions upon continuous deformation of field configurations leads to global chiral symmetry breaking of the underlying fundamental theory, imposes rigorous restrictions on the structure of the vacuum and space-time itself and determines uniquely the gauge structure and matter content.
NTIS
Chirality; Fermions

20040087348 State Univ. of New York, Albany, NY, USA
Effect of Low Temperature Baking on Niobuim Cavities
Giovati, G.; Kneisel, P.; Myneni, G.; 2003; In English
Report No.(s): DE2003-816811; No Copyright; Avail: National Technical Information Service (NTIS)

A low temperature (100 C-150 C) 'in situ' baking under ultra-high vacuum has been successfully applied as final preparation of niobium RF cavities by several laboratories over the last few years. The benefits reported consist mainly of an improvement of the cavity quality factor and a recovery from the so-called 'Q-drop' without field emission at high field. A series of experiments with a CEBAF single cell cavity have been carried out at Jefferson Lab to carefully investigate the effect of baking at progressively higher temperatures for a fixed time on all the relevant material parameters. Measurements of the cavity quality factor in the temperature range 1. 37K-280K and resonant frequency shift between 6K-9.3K provide information about the surface resistance, energy gap, penetration depth and mean free path.
NTIS
Niobium; Cavities; Thermal Conductivity; Field Emission

20040087367 National Renewable Energy Lab., Golden, CO, Cornell Univ., Ithaca, NY, USA
Elastic Properties of Thin Film Silicon
Pohl, R. O.; 2003; In English
Report No.(s): DE2003-15004716; NREL/SR-520-34624; No Copyright; Avail: National Technical Information Service (NTIS)

The original purpose of this research, as stated in the annual reports, was the study of the role of hydrogen in thin (polycrystalline) silicon films. We quote from the 2001 Annual Report: Thin-film silicon holds great promise as a semiconductor that can be produced economically on a large scale. Its exceptional properties for photovoltaic energy conversion have already been demonstrated and are the subject of intensive study worldwide. Yet the entire field of heterogeneous thin-film silicon (often referred to as polycrystalline silicon) is remarkably poorly understood. This is not too surprising, given our limited understanding of one of its constituents, amorphous silicon, in particular in its hydrogenated form. In the thin-film silicon, the interfaces between crystalline grains and between crystalline and amorphous regions appear to be of particular importance, since they are likely to lead to the exceptionally large optical absorption observed in these films, which exceeds that of both c-Si and a-Si:H. The understanding of the interfacial regions is, however, entirely lacking. What is their fractional volume, and how can it be controlled. Where is the hydrogen located in these films, and what is its role in their electronic properties. A better understanding of these fundamental questions is crucial for the development of better photovoltaic devices, and for any other technological application as well. This is the objective of the present study.
NTIS
Silicon; Thin Films; Hydrogen; Polycrystals

20040088875 Princeton Univ., NJ
Constructing Integrable High-Pressure Full-Current Free-Boundary Stellarator Magnetohydrodynamic Equilibrium Solutions
2003; In English
Report No.(s): DE2003-815091; PPPL-3867; No Copyright; Avail: National Technical Information Service (NTIS)

For the (non-axisymmetric) stellarator class of plasma confinement devices to be feasible candidates for fusion power stations it is essential that, to a good approximation, the magnetic field lines lie on nested flux surfaces; however, the inherent lack of a continuous symmetry implies that magnetic islands responsible for breaking the smooth topology of the flux surfaces are guaranteed to exist. Thus, the suppression of magnetic islands is a critical issue for stellarator design, particularly for small aspect ratio devices. Pfrsch-Schluter currents, diamagnetic currents and resonant coil fields contribute to the formation of magnetic islands, and the challenge is to design the plasma and coils such that these effects cancel. Magnetic islands in free-boundary high-pressure full-current stellarator magnetohydrodynamic equilibria are suppressed using a procedure based

on the Princeton Iterative Equilibrium Solver (Comp. Phys. Comm., 43:157, 1986) which iterates the equilibrium equations to obtain the plasma equilibrium. At each iteration, changes to a Fourier representation of the coil geometry are made to cancel resonant fields produced by the plasma. The changes are constrained to preserve certain measures of engineering acceptability and to preserve the stability of ideal kink modes. As the iterations continue, the coil geometry and the plasma simultaneously converge to an equilibrium in which the island content is negligible, the plasma is stable to ideal kink modes, and the coils satisfy engineering constraints. The method is applied to a candidate plasma and coil design for the National Compact Stellarator eXperiment (Phys. Plas. 8(5):2083, 2001).
NTIS
Magnetohydrodynamics; Stellarators; Equilibrium

20040089140 Princeton Univ., NJ
Diagnostics for the National Compact Stellarator Experiment
Stratton, B. C.; Johnson, D.; Feder, R.; Fredrickson, E.; Neilson, H.; Sep. 2003; In English
Report No.(s): DE2003-815100; PPPL-3872; No Copyright; Avail: National Technical Information Service (NTIS)

The status of planning of NCSX diagnostics is presented, with the emphasis on resolution of diagnostics access issues and on diagnostics required for the early phases of operation.
NTIS
Stellarators; Diagnosis

20040089447 Fermi National Accelerator Lab., Batavia, IL, USA, Deutsches Elektronen-Synchrotron, Hamburg, Germany, Chonbuk National Univ., Chonju, Korea, Republic of
Reconstruction of Fundamental SUSY Parameters
Zerwas, P. M.; 2003; In English
Report No.(s): DE2003-815214; FERMILAB-CONF-02/385; No Copyright; Avail: National Technical Information Service (NTIS)

We summarize methods and expected accuracies in determining the basic low-energy SUSY parameters from experiments at future e(sup +)+e(sup -) linear colliders in the TeV energy range, combined with results from LHC. In a second step we demonstrate how, based on this set of parameters, the fundamental supersymmetric theory can be reconstructed at high scales near the grand unification or Planck scale. These analyses have been carried out for minimal supergravity (confronted with GMSB for comparison), and for a string effective theory.
NTIS
Supersymmetry; String Theory

20040089982 Argonne National Lab., IL
High Energy Physics Division Semiannual Report of Research Activities for July 1, 2002 through December 31, 2002
2003; In English
Report No.(s): DE2003-815663; ANL-HEP-TR-03-48; No Copyright; Avail: National Technical Information Service (NTIS)

This report describes the research conducted in the High Energy Physics Division of Argonne National Laboratory during the period of July 1 through December 31, 2002. Topics covered here include experimental and theoretical particle physics, advanced accelerator physics, detector development, and experimental facilities research. Lists of Division publications and colloquia are included.
NTIS
Particle Accelerators; Theoretical Physics

20040090301 Fermi National Accelerator Lab., Batavia, IL, USA, Argonne National Lab., IL, Chicago Univ., Chicago, IL
Virtual Data in CMS Analysis
Arbree, A.; Avery, P.; Bourilkov, D.; Cavanaugh, R.; Rodriguez, J.; 2003; In English
Report No.(s): DE2003-815751; No Copyright; Avail: National Technical Information Service (NTIS)

The use of virtual data for enhancing the collaboration between large groups of scientists is explored in several ways: - by defining ‘virtual’ parameter spaces which can be searched and shared in an organized way by a collaboration of scientists in the course of their analysis - by providing a mechanism to log the provenance of results and the ability to trace them back to the various stages in the analysis of real or simulated data - by creating ‘check points’ in the course of an analysis to permit collaborators to explore their own analysis branches by refining selections, improving the signal to background ratio, varying

the estimation of parameters, etc. - by facilitating the audit of an analysis and the reproduction of its results by a different group, or in a peer review context.
NTIS
Scientists; Refining; Analyzing

20040090447 Argonne National Lab., IL
Lifetime Studies at the Aps
2003; In English
Report No.(s): DE2003-816763; No Copyright; Avail: National Technical Information Service (NTIS)

The studies presented in this note are focused on the lifetime characterization with positrons for the symmetrical low(beta)(sub y) lattice. Before switching back to electrons, detailed lifetime studies were performed in order to gather data that could be compared to similar ones with electrons, the ultimate goal being to define a model that could be used to predict lifetimes. The report is divided into three parts: simulations to allow decoupling of the different contributions to the lifetime; review of the experimental conditions and related problems; and analysis of the data and discussion of the limitations.
NTIS
Positrons; Decoupling

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ACOUSTICS

Includes sound generation, transmission, and attenuation. For noise pollution see *45 Environment Pollution*. For aircraft noise see also *02 Aerodynamics* and *07 Aircraft Propulsion and Power*.

20040086151 California Univ., Los Angeles, CA
Blind Beamforming for Collaborative Array Processing in Sensor Networks
Yao, Kung; May 2004; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-02-1-0186; DARPA ORDER-N374; Proj-N374
Report No.(s): AD-A424487; AFRL-IF-RS-TR-2004-137; No Copyright; Avail: CASI; A03, Hardcopy

The detection, localization, tracking, and identification of a single target by acoustical/seismic measured data are fairly well understood. Many of the methods considered in the SensIT program proven in various ways for a single target in an open-air environment, will not be applicable to multiple targets. In the proposal, we advocated a new algorithm based on an efficient computational Approximate Maximum-Likelihood (AML) method using alternate projection to tackle the multiple target cases. The idea is that instead of performing the AML search in high dimensions for M targets, we first perform the ML estimate for the strongest target, then by fixing that target, we perform the ML estimate for the second strongest target, until the M-th target, and then iterate with the first target again.
DTIC
Beamforming; Detection; Maximum Likelihood Estimates; Target Acquisition; Targets

20040086240 Naval Postgraduate School, Monterey, CA
Effects of a Suspended Sediment Layer on Acoustic Imagery
Cornelius, Michael; Jun. 2004; 64 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424675; No Copyright; Avail: CASI; A04, Hardcopy

The Navy’s CASS/GRAB sonar model is used to accurately simulate a side-scan sonar image with a mine-like object present through its reverberation characteristics. The acoustic impact of a suspended sediment layer is investigated numerically using CASS/GRAB through changing the volume scattering characteristics of the lower water column. A range of critical values of volume scattering strength were discovered through repeated model simulations. An understanding of the acoustic characteristics of suspended sediment layers can aid the Navy in the detection of mines that might exist within these layers.
DTIC
Imagery; Mine Detectors; Sediments; Sonar

20040086245 Naval Postgraduate School, Monterey, CA
Direct-Sequence Spread-Spectrum Acoustic Communications With CRV decomposition
Angelopoulos, Pavlos; Jun. 2004; 115 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424689; No Copyright; Avail: CASI; A06, Hardcopy

Direct-Sequence Spread-Spectrum (DS-SS) is among the preferred modulation techniques for military applications. DS-SS offers three greatly desired characteristics. It allows for the development of Low Probability of Detection (LPD) and Low Probability of Intercept (LPI) systems and has a very good performance in fading channels. This thesis investigates the performance of the 'Cross-Product RV (CRV) decomposition' as the basis of blind-equalization algorithms. The CRV is a rank-revealing decomposition alter- native to the Eigenvalue Decomposition (EVD) that can provide a recursively updated estimate of the signal and noise subspace at a reduced computational cost. The CRV updating algorithm is implemented in MATLAB and evaluated in a previously proposed communication scheme intended for use in an underwater acoustic network called Sea-web. The underwater channel is modeled with the Monterey-Miami Parabolic Equation Model (MMPE) for various multipath perturbations. The receiver performance is examined using a Monte Carlo simulation. Bit-error rates versus signal-to-noise ratio are presented for various, noise assumptions, and receiver synchronization assumptions.
DTIC
Acoustics; Communication; Decomposition; Multipath Transmission; Sound Transmission; Spread Spectrum Transmission; Underwater Acoustics

20040086253 Dartmouth Coll., Hanover, NH
Instrumentation for Basic Research in Communication and Hearing Protection Systems
Ray, Laura; Jun. 16, 2004; 12 pp.; In English
Contract(s)/Grant(s): F49620-03-2-0248
Report No.(s): AD-A424702; No Copyright; Avail: CASI; A03, Hardcopy

This DURIP grant supported instrumentation to perform basic research in control theory, hearing protector design, and psychoacoustics. The research is aimed at developing and evaluating hearing protection and communication systems for environments in which the user is exposed to high levels of nonstationary noise. The instrumentation provided by this grant consists of an Artificial Head Measurement System, a Low Frequency Acoustic Test Cell, a vibration isolation table, and digital signal processing equipment for rapid prototyping of active noise reduction (ANR) algorithms based on feedforward adaptive filters. During the performance period, the instrumentation directly supported graduate and undergraduate research work on hybrid ANR system and speech intelligibility metrics. Tests of hybrid ANR systems, using both feed-forward and feed-back control, were conducted using aircraft noise. The report covers the instrumentation and its costs along with the research work that it supported. Research projects included the development of a digital, hybrid ANR system using feedforward adaptive control for hearing protection. The system consists of a Lyapunov-tuned LMS filter and a digital feedback ANR system. Another project focused on the effects of speaker dynamics on ANR. This work characterized a variety of off-the-shelf speakers and evaluated the use of a filtered-X LMS filter for flattening the transfer function from the speaker to error microphone, versus using digital equalization to flatten the response. In another project, testing provided evidence that ANR improves speech intelligibility through reduction of low frequency noise. The final project dealt with the development of hearing protection for extreme noise fields. In addition to passive and active noise reduction of the air transmission path, active structural control and passive noise control through design of the helmet structure may be required to reduce bone conducted noise through the skull. (9 refs7
DTIC
Adaptive Control; Digital Systems; Ear Protectors; Intelligibility; Noise Reduction; Psychoacoustics; Telecommunication

20040086273 Washington Univ., Seattle, WA
Proceedings, ONR Shallow Water Acoustics 2006 Workshop Applied Physics Laboratory, University of Washington 25-26 September 2003
Tang, Dajun; Makris, Nick; Lynch, James; Apr. 2004; 20 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-03-1-0948
Report No.(s): AD-A424744; APL-UW-TR-0403; No Copyright; Avail: CASI; A03, Hardcopy

The Ocean Acoustics Code, Office of Naval Research, sponsored a two-day workshop on shallow water acoustics. The primary purpose of the workshop was to define and identify key basic research problems to be addressed in a field experiment to be conducted in fiscal year 2006. Seventeen scientists attended the workshop. Several researchers contributed poster presentations as well. The report consists of an 18-page workshop summary, 18 PowerPoint presentations, and 8 poster presentations.
DTIC
Acoustics; Conferences; Shallow Water; Underwater Acoustics

20040086655 NASA Langley Research Center, Hampton, VA, USA
Application of NASA General-Purpose Solver to Large-Scale Computations in Aeroacoustics
Watson, Willie R.; Storaasli, Olaf O.; [2004]; 16 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Of several iterative and direct equation solvers evaluated previously for computations in aeroacoustics, the most promising was the NASA-developed General-Purpose Solver (winner of NASA's 1999 software of the year award). This paper presents detailed, single-processor statistics of the performance of this solver, which has been tailored and optimized for large-scale aeroacoustic computations. The statistics, compiled using an SGI ORIGIN 2000 computer with 12 Gb available memory (RAM) and eight available processors, are the central processing unit time, RAM requirements, and solution error. The equation solver is capable of solving 10 thousand complex unknowns in as little as 0.01 sec using 0.02 Gb RAM, and 8.4 million complex unknowns in slightly less than 3 hours using all 12 Gb. This latter solution is the largest aeroacoustics problem solved to date with this technique. The study was unable to detect any noticeable error in the solution, since noise levels predicted from these solution vectors are in excellent agreement with the noise levels computed from the exact solution. The equation solver provides a means for obtaining numerical solutions to aeroacoustics problems in three dimensions.
Author
Aeroacoustics; Computation; Numerical Analysis; Noise Intensity

20040086686 NASA Langley Research Center, Hampton, VA, USA
Comparison of Modal Analysis Methods Applied to a Vibro-Acoustic Test Article
Pritchard, Jocelyn; Pappa, Richard; Buehrle, Ralph; Grosveld, Ferdinand; [2001]; 99999 pp.; In English
Report No.(s): NASA-2002-IMACXX-JIP; No Copyright; Avail: CASI

Modal testing of a vibro-acoustic test article referred to as the Aluminum Testbed Cylinder (ATC) has provided frequency response data for the development of validated numerical models of complex structures for interior noise prediction and control. The ATC is an all aluminum, ring and stringer stiffened cylinder, 12 feet in length and 4 feet in diameter. The cylinder was designed to represent typical aircraft construction. Modal tests were conducted for several different configurations of the cylinder assembly under ambient and pressurized conditions. The purpose of this paper is to present results from dynamic testing of different ATC configurations using two modal analysis software methods: Eigensystem Realization Algorithm (ERA) and MTS IDEAS Polyreference method. The paper compares results from the two analysis methods as well as the results from various test configurations. The effects of pressurization on the modal characteristics are discussed.
Author
Acoustics; Aluminum; Vibration Tests; Mathematical Models; Test Stands

20040086771 NASA Langley Research Center, Hampton, VA, USA
The Integration of Delta Prime (f)in a Multidimensional Space
Farassat, F.; August 17, 1999; 5 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Consideration is given to the thickness noise term of the Ffowcs Williams-Hawkings equation when the time derivative is taken explicitly. An interpretation is presented of the integral I = function phi(x)delta-prime(f) dx, where it is initially assumed that the absolute value of Del-f is not equal to 1 on the surface f = 0.
CASI
Integral Equations; Acoustics; Entire Functions; Thickness

20040086809 NASA Langley Research Center, Hampton, VA, USA
Finite Element and Plate Theory Modeling of Acoustic Emission Waveforms
Prosser, W. H.; Hamstad, M. A.; Gary, J.; OGallagher, A.; [1998]; 21 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

A comparison was made between two approaches to predict acoustic emission waveforms in thin plates. A normal mode solution method for Mindlin plate theory was used to predict the response of the flexural plate mode to a point source, step-function load, applied on the plate surface. The second approach used a dynamic finite element method to model the problem using equations of motion based on exact linear elasticity. Calculations were made using properties for both isotropic (aluminum) and anisotropic (unidirectional graphite/epoxy composite) materials. For simulations of anisotropic plates, propagation along multiple directions was evaluated. In general, agreement between the two theoretical approaches was good. Discrepancies in the waveforms at longer times were caused by differences in reflections from the lateral plate boundaries. These differences resulted from the fact that the two methods used different boundary conditions. At shorter times in the signals, before reflections, the slight discrepancies in the waveforms were attributed to limitations of Mindlin plate theory,

which is an approximate plate theory. The advantages of the finite element method are that it used the exact linear elasticity solutions, and that it can be used to model real source conditions and complicated, finite specimen geometries as well as thick plates. These advantages come at a cost of increased computational difficulty, requiring lengthy calculations on workstations or supercomputers. The Mindlin plate theory solutions, meanwhile, can be quickly generated on personal computers. Specimens with finite geometry can also be modeled. However, only limited simple geometries such as circular or rectangular plates can easily be accommodated with the normal mode solution technique. Likewise, very limited source configurations can be modeled and plate theory is applicable only to thin plates.
Author
Acoustic Emission; Plate Theory; Finite Element Method; Mathematical Models; Mindlin Plates

20040086837 NASA Langley Research Center, Hampton, VA, USA
Computational Aeroacoustic Analysis of Slat Trailing-Edge Flow
Singer, Bart A.; Lockhard, David P.; Brentner, Kenneth S.; Khorrami, Mehdi R.; Berkman, Mert E.; Choudhari, Meelan; [1999]; 12 pp.; In English; 5th AIAA/CEAS Aeroacoustics Conference, 10-12 May 1999, Greater Seattle, WA, USA
Report No.(s): AIAA Paper 99-1802; Copyright; Avail: CASI; A03, Hardcopy

An acoustic analysis based on the Ffowcs Williams and Hawkings equation was performed for a high-lift system. As input, the acoustic analysis used un- steady flow data obtained from a highly resolved, time-dependent, Reynolds-averaged Navier-Stokes calculation. The analysis strongly suggests that vor- tex shedding from the trailing edge of the slat results in a high-amplitude, high-frequency acoustic signal, similar to that which was observed in a correspond- ing experimental study of the high-lift system.
Author
Computation; Aeroacoustics; Signal Analyzers; Signal Transmission; Sound Waves

20040087387 National Renewable Energy Lab., Golden, CO
Power Performance Test Report for the Southwest Windpower AIR-X Wind Turbine
van Dam, J.; Meadors, M.; Link, H.; Migliore, P.; 2003; In English
Report No.(s): DE2003-15004827; NREL/TP-500-34756; No Copyright; Avail: National Technical Information Service (NTIS)

In the period from 14 October 2002 to 16 January 2003, an early production version of Southwest Windpower's AIR-X turbine was installed at the NWTC test site for acoustic noise testing. In addition to the signals required for the noise testing, additional instrumentation that allowed power performance testing in accordance with IEC 61400-12 was added. The results of that test are described in this report. Please note that this test and the test report are not an accredited power performance test/test report because parts of the NWTC quality assurance system were not followed.
NTIS
Wind Turbines; Performance Tests

20040090459 NASA Langley Research Center, Hampton, VA, USA
Validation of an Impedance Education Method in Flow
Watson, Willie R.; Jones, Michael G.; Parrott, Tony L.; [2004]; 16 pp.; In English; 4th AIAA/CEAS, 2-4 Jun. 1998, Toulouse, France
Report No.(s): AIAA-98-2279; Copyright; Avail: CASI; A03, Hardcopy

This paper reports results of a research effort to validate a method for educing the normal incidence impedance of a locally reacting liner, located in a grazing incidence, nonprogressive acoustic wave environment with flow. The results presented in this paper test the ability of the method to reproduce the measured normal incidence impedance of a solid steel plate and two soft test liners in a uniform flow. The test liners are known to be locally react- ing and exhibit no measurable amplitude-dependent impedance nonlinearities or flow effects. Baseline impedance spectra for these liners were therefore established from measurements in a conventional normal incidence impedance tube. A key feature of the method is the expansion of the unknown impedance function as a piecewise continuous polynomial with undetermined coefficients. Stewart's adaptation of the Davidon-Fletcher-Powell optimization algorithm is used to educe the normal incidence impedance at each Mach number by optimizing an objective function. The method is shown to reproduce the measured normal incidence impedance spectrum for each of the test liners, thus validating its usefulness for determining the normal incidence impedance

of test liners for a broad range of source frequencies and flow Mach numbers. Nomenclature
Author
Algorithms; Sound Waves; Acoustic Emission

20040090461 NASA Langley Research Center, Hampton, VA, USA
Liner Optimization Studies Using the Ducted Fan Noise Prediction Code TBIEM3D
Dunn, M. H.; Farassat, F.; [1998]; 10 pp.; In English; 4th AIAA/CEAS Aeroacoustics Conference, 2-4 Jun. 1998, Toulouse, France
Report No.(s): AIAA Paper 98-2310; Copyright; Avail: CASI; A02, Hardcopy

In this paper we demonstrate the usefulness of the ducted fan noise prediction code TBIEM3D as a liner optimization design tool. Boundary conditions on the interior duct wall allow for hard walls or a locally reacting liner with axially segmented, circumferentially uniform impedance. Two liner optimization studies are considered in which farfield noise attenuation due to the presence of a liner is maximized by adjusting the liner impedance. In the first example, the dependence of optimal liner impedance on frequency and liner length is examined. Results show that both the optimal impedance and attenuation levels are significantly influenced by liner length and frequency. In the second example, TBIEM3D is used to compare radiated sound pressure levels between optimal and non-optimal liner cases at conditions designed to simulate take-off. It is shown that significant noise reduction is achieved for most of the sound field by selecting the optimal or near optimal liner impedance. Our results also indicate that there is relatively large region of the impedance plane over which optimal or near optimal liner behavior is attainable. This is an important conclusion for the designer since there are variations in liner characteristics due to manufacturing imprecisions.
Author
Aerodynamic Noise; Ducted Fans; Boundary Conditions; Sound Fields; Noise Prediction; Linings

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ATOMIC AND MOLECULAR PHYSICS

Includes atomic and molecular structure, electron properties, and atomic and molecular spectra. For elementary particle physics see *73 Nuclear Physics*.

20040086116 Naval Research Lab., Washington, DC
PHILLS-1 Hyperspectral Data Processing: 2001 LEO- 15 Deployment
Snyder, William A.; Davis, Curtiss O.; Bowles, Jeffrey H.; Chen, Wei; Gao, Bo-Cai; May 26, 2004; 29 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424413; NRL/FR/7230--04-10060; No Copyright; Avail: CASI; A03, Hardcopy

The Portable Hyperspectral Imager for Low-Light Spectroscopy (PHILLS) is a hyperspectral imager specifically designed for imaging the coast ocean. It was deployed at LEO- 15 during July 22 through August 2, 2001. This report describes the LEO-15 2001 PHILLS-1 data that were collected and how they were processed to obtain calibrated and atmospherically corrected remote sensing reflectance images. This includes descriptions of laboratory spectral and radiance calibration procedures, how laboratory calibrations are adjusted to match field collected data, and how the data can then be atmospherically corrected and georectified.
DTIC
Calibrating; Deployment; Imagery; Low Earth Orbits; Portable Equipment

20040086121 Massachusetts Inst. of Tech., Cambridge, MA
Strategic Applications of Ultra-Cold Atoms; MURI Fellowship for J.R. Abo-Shaeer
Ketterie, Wolfgang; Jun. 14, 2004; 11 pp.; In English
Contract(s)/Grant(s): DAAD19-00-1-0459
Report No.(s): AD-A424422; ARO-41589.5-PH-MUR; No Copyright; Avail: CASI; A03, Hardcopy

The goal of the MURI project is to advance matter wave sensors by combining atom interferometry with atom lasers and atom waveguides. This has the prospect of improving the sensitivity of such sensors by orders of magnitude as compared with existing state-of-the-art sensors. This final report summarizes major steps towards this goal, including the study of wave guides using atom chips, the demonstration of the novel method of contrast interferometry with Bose-Einstein condensates, and the realization of a prototype trapped atom interferometer using optical potentials. Furthermore, other scientific contributions of

Jamil Abo-Shaeer, the student supported by the MURI fellowship, are reported: the study of vortices, sound and ultracold molecules.
DTIC
Interferometry

20040086147 Yale Univ., New Haven, CT
Strategic Applications of Ultracold Atoms
Kasevich, Mark; May 20, 2004; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD-19-00-1-0169
Report No.(s): AD-A424482; TR-3; ARO-41064.1-PH-MUR; No Copyright; Avail: CASI; A03, Hardcopy

This consortium has initiated a focused collaborative program to advance matter wave sensors. We seek to combine atom interferometry with atom lasers and atom waveguides with the prospect of improving the sensitivity of such sensors by orders of magnitude as compared with existing state-of-the-art sensors. We will identify, explore and exploit fundamental scientific possibilities surrounding the production, manipulation and detection of ultra-cold atoms for a variety of sensing applications. Such sensors include gravimeters, gravity gradiometers, gyroscopes, magnetometers and frequency standards and have applications in science and technology and within the DOD. Sensitive and accurate inertial force sensors can be used in covert/passive navigation, precision guidance, underground structure detection, gravitational mapping, etc. They are non-emanating and capable of operating in a jammed-GPS environment. We seek to build awareness of DOD needs critical to national defense at the graduate training level, and to establish a dialogue between DOD and industrial researchers/ managers and PhD trainees. The institutions identified in the proposed consortium attract talented students who are likely to become future leaders in science and technology.
DTIC
Bose-Einstein Condensates; Interferometry

20040086161 Mission Research Corp., Santa Barbara, CA
Next Generation LWIR Spectrum Projector (CB-2) Design Study
Thomas, M. C.; Jun. 2004; 26 pp.; In English
Contract(s)/Grant(s): DAAD05-99-P-1008
Report No.(s): AD-A424508; MRC-R-1597; ECBC-CR-067; No Copyright; Avail: CASI; A03, Hardcopy

This document outlines the basic optical requirements for the next generation LWIR spectrum projector (CB-2) and the two best ways to meet those requirements. Based upon the success of the CB-1 Spectrum Projector built and tested by MRC, Dugway Proving Ground, Block Engineering and Edgewood Research Development and Engineering Center (now U.S. Army Edgewood Chemical Biological Center), a new and improved DB-2 is being designed. The preliminary designs for the CB-2 are enclosed along with their expected performances. Aspects for the CB-2 system not discussed in this report are the drive electronics for the emitter array, the calibration procedure and requirements, and the necessary steps for making calibrated movies to drive the emitters.
DTIC
Projectors; Spectra

20040086201 Massachusetts Inst. of Tech., Cambridge, MA
Ensemble Quantum Computing by Liquid-State NMR Spectroscopy
Havel, Timothy F.; Cory, David G.; Oct. 21, 2003; 13 pp.; In English
Contract(s)/Grant(s): DAAD19-01-1-0678
Report No.(s): AD-A424609; ARO-42747.20-PH; No Copyright; Avail: CASI; A03, Hardcopy

We propose to use NMR as a testbed to develop general methods for solving computational problems on EQC's, to study the fundamental physics and computer science of these machines, and to learn how to make optimal use of the trade- offs that their unique capabilities permit us to make. Specifically, we intend to explore the critical issue of decoherence in a real quantum information processor, including its nature, its simulation, and methods of controlling it. The lessons thereby learned are expected to be broadly applicable throughout the field of quantum information processing, and particularly to proposed implementations based on solid-state NMR. Liquid-state NMR is thus an invaluable if not indispensable step in the field's efforts to bootstrap its way towards scalable quantum information processing. The results obtained during the two years covered by this report (July 1, 2001 - June 30, 2003) fall into four principal classes: 1) Development of methods for obtaining precise coherent control over nuclear spin systems with a well-characterized Hamiltonian and relaxation superoperator, and

for quantifying the precision of such control. 2) Validation of these methods by implementing simple quantum algorithms, communications protocols, and other quantum phenomena that make essential use of entangling unitary operations and/or measurements. 3) Simulation of quantum systems using the unitary and nonunitary control operations that are available in liquid-state NMR spectroscopy. 4) Reviews, commentary and educational articles. We stress that although these studies utilized liquid-state NMR spectroscopy as a testbed for the development and validation of our techniques and simulations, the results will be directly applicable to a wide range of physical systems now being studied for quantum information processing purposes, once sufficient favorable ratios of gate operation to decoherence times have been obtained.
DTIC
Nuclear Magnetic Resonance; Quantum Computation; Quantum Theory; Spectroscopy

20040086622 Moscow State Univ., Russia
Mechanism of Giant Enhancement of Hyper-Rayleigh Scattering in Silver Nanostructures
Kim, E. M.; Elovikov, S. S.; Muzychenko, D. A.; Aktsipetrov, O. A.; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 35-39; In English; See also 20040086587; No Copyright; Avail: CASI; A01, Hardcopy

Hyper-Rayleigh Scattering in optical second harmonic generation was experimentally observed in silver island films. A combined analysis of the nonlinear scattering patterns in combination with the analysis of the results of atomic-force microscopy revealed the fractal nature of the films. Mechanism of giant enhancement in ultradispersed metal systems was observed with the help of dielectric wedge coating a semiconductor substrate layer.
Author
Dielectrics; Metal Films; Nanostructures (Devices); Rayleigh Scattering; Silver

73
NUCLEAR PHYSICS

Includes nuclear particles; and reactor theory. For space radiation see *93 Space Radiation*. For atomic and molecular physics see *72 Atomic and Molecular Physics*. For elementary particle physics see *77 Physics of Elementary Particles and Fields*. For nuclear astrophysics see *90 Astrophysics*.

20040090444 Argonne National Lab., IL
Oxidation of Zppr Fuel Corrosion Products: National Spent Fuel Program FY 1999 Final Report
Totemeier, T. C.; 2003; In English
Report No.(s): DE2003-816758; ANL-99/21; No Copyright; Avail: National Technical Information Service (NTIS)

The oxidation behavior of hydride-bearing corrosion products from uranium metal ZPPR fuel plates was studied in Ar-O(sub 2), Ar-H(sub 2)O, Ar-O(sub 2)-H(sub 2)O, dry air, and moist air environments. Both isothermal and burning curve tests in the different environments were performed using a thermo-gravimetric analyzer. The effect of pre-oxidation in each environment on subsequent ignition temperature was investigated by performing burning curve tests on samples after isothermal oxidation. Low-temperature oxidation rates in Ar-O(sub 2) and dry air environments were identical. Oxidation rates in moist environments were slightly higher, but the difference was not statistically significant at 95% confidence.
NTIS
Spent Fuels; Fuel Corrosion

74
OPTICS

Includes light phenomena and the theory of optical devices; for specific optical devices see also *35 Instrumentation and Photography*. For lasers see *36 Lasers and Masers*.

20040086134 Pennsylvania Univ., Philadelphia, PA
Advanced Broadband Intrusion Detection Engine (ABIDE): Report on Seedling Project
Smith, Jonathan; Greenwald, Michael; Lewis, E.; Lu, Honghui; Jun. 13, 2003; 13 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-02-1-0404
Report No.(s): AD-A424460; ARO-44233.1-C1; No Copyright; Avail: CASI; A03, Hardcopy

ABIDE, the 'Advanced Broadband Intrusion Detection Engine", is a model for applying parallel processing to the

increasing bandwidths present in optical fibers in a manner which will scale with increases in the number of lambdas in a WDM scheme. Our initial support from ARO was used to investigate design parameters, and we report a scheme that we believe will in fact allow sophisticated intrusion detection to operate on the entirety of a fiber's bandwidth. The design principle we employ is novel, consisting of alternating bands of filtering and aggregation functions organized into a virtual tree, which is then mapped to the underlying ABIDE hardware system. The aggregation/ filtering adjacencies allow localized tuning at the boundary. For example, if an upstream filtering system is overwhelmed, predecessor (downstream) aggregation functions must get backpressure to decrease the number of streams merged. We call this scheme Filtering Aggregation Bands (FAB). We are prepared to continue this research and perform a more detailed experimental investigation for ARO along the lines of our original proposal.
DTIC
Broadband; Detection; Fiber Optics; Parallel Processing (Computers); Warning Systems

20040086187 Michigan Univ., Ann Arbor, MI
Compact Reconfigurable High-Frequency Ultrahigh Frequency (HG-UHF) Antenna
Sarabandi, Kamal; Jan. 2003; 71 pp.; In English
Contract(s)/Grant(s): DAAD19-99-1-0197
Report No.(s): AD-A424574; ARO-39879.1-EL; No Copyright; Avail: CASI; A04, Hardcopy

The goal of this research effort was the development of computer algorithms for the predication of radio wave propagation in forest or Vegetated environments. In addition, recognizing the need for measured data sets for validation of such modesi, two measurements Campaigns were conducted, one to determine path loss for near-Earth propagation and one which utilizes a unique, synchronized, long-range measurement system (the system has been tested to over a kilometer, and in principle will work over longer ranges), developed for this project, and which allos for the evaluation of both pathioss and frequency decorrelation. Since the stan of the project in May, 2001, significant progress was made towards achieving the project goal. A physics%based methodology was used, in which the actual physical scenario of a given propagatIon problem or environment is modeled. A description of this physics- based methodology and why this approach is applied is given in the final technical report. The impact of this effort on FOS and related programs is then discussed, followed by a brief summary of the project accomplishments. Completed work is then described. Where noted, expanded and detailed discussions of several of the developed algorithms is later given.
DTIC
Ultrahigh Frequencies; Wave Propagation

20040086587 NASA Glenn Research Center, Cleveland, OH, USA
2004 Photon Correlation and Scattering Conference
Meyer, William, Editor; Smart, Anthony, Editor; Wegdam, Gerard, Editor; Dogariu, Aristide, Editor; Carpenter, Bradley, Editor; August 2004; 126 pp.; In English; 2004 Photon Correlation and Scattering Conference, 16-18 Aug. 2004, Amsterdam, Netherlands; See also 20040086588 - 20040086623
Contract(s)/Grant(s): WBS 22-101-58-09
Report No.(s): NASA/CP-2004-213207; E-14715; No Copyright; Avail: CASI; A07, Hardcopy

The Photon Correlation and Scattering (PCS) meeting welcomes all who are interested in the art and science of photon correlation and its application to optical scattering. The meeting is intended to enhance interactions between theory, applications, instrument design, and participants.
Author
Photons; Light Scattering; Near Fields; Physical Optics; Optical Properties

20040086592 University of the West Indies, Saint Augustine, Trinidad and Tobago
Coupling of Correlated Entangled Photons Into Single-Mode Optical Fibers
Andrews, R.; Pike, E. R.; Sarkar, Sarben; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 83-85; In English; See also 20040086587; No Copyright; Avail: CASI; A01, Hardcopy

We present a multimode theory that describes the coupling of single photons generated by collinear Type-I parametric down-conversion into single-mode optical fibers. An expression for the fiber diameter which maximizes the coupling is obtained.
Author
Optical Fibers; Collinearity; Photons; Fiber Optics; Momentum

20040086597 Chernivtsi State Univ., Chernivtsi, Ukraine

On the Prospects of Diagnostic of Wave Dislocation Obtained in Light

Angelsky, O. V.; Maksimyak, A. P.; Maksimyak, P. P.; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 91-92; In English; See also 20040086587; No Copyright; Avail: CASI; A01, Hardcopy

The possibility of application of edge and screw dislocations of the field, obtained in polychromatic light for diagnostics of different phase-inhomogeneous structures, including nano-structures has been considered.

Author

Diagnosis; Diffraction; Edge Dislocations; Screw Dislocations

20040086599 Marine Technical Univ., Saint Petersburg, Russia

Measurement of the Dispersity of Multicomponent Mixtures of Monodisperse Latexes by the Dynamic Light Scattering Method

Dioujeva, M. S.; Klyubin, V. V.; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 105-106; In English; See also 20040086587; No Copyright; Avail: CASI; A01, Hardcopy

At present, the methods of optical and electron microscopy, sedimentation, measuring of light scattering indicatrix, dynamic light scattering (DLS), etc., are used to determine the sizes of micron and submicron particles. All aforementioned methods have their advantages and disadvantages. This work deals with the study of the potentialities of dynamic light scattering method for measuring the sizes of colloidal particles in samples characterized by wide distributions and consisting of several narrow-disperse components (fractions). An attempt was made to analyze the errors encountered in such measurements. This study continues a series of works devoted to the analysis of the potentialities of a mathematical apparatus used to process experimental data of the DLS method. Concepts underlying the software packages used for processing the autocorrelation function of fluctuations in the current induced by a scattered light in a photodetector were described in the first work of this series. In the same work, the authors analyzed the influence of errors in registering the correlation function on the optimal value of the regularization parameter used for the restoration of the particle size distribution. In the second work, the CONTIN and KLUB software packages used for processing experimental data were compared. This work consists of two parts: the experimental measurement of the dispersity of real colloids and computer-assisted calculations, which made it possible to compare the measured distributions with the actual ones and to determine the character of distortions arising in such measurements.

Author (revised)

Light Scattering; Latex; Microparticles; Size Determination

20040086607 Deutsches Elektronen-Synchrotron, Hamburg, Germany

Correlation Spectroscopy With Coherent X-Rays

Gruebel, Gerhard; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 59; In English; See also 20040086587; No Copyright; Avail: CASI; A01, Hardcopy

X-ray photon correlation spectroscopy (XPCS) is a novel technique for the study of slow dynamics in disordered materials. It overcomes limitations of visible light scattering techniques such as multiple scattering or limitations in Q-range by using coherent X-rays from third generation synchrotron radiation sources. Applications to the static and dynamic behavior of complex fluids and to slow dynamics in hard condensed matter systems are reviewed.

Author

Spectroscopy; X Rays; Coherent Radiation; Photons

20040086608 Centre National de la Recherche Scientifique, Paris, France

Using Diffusing-Wave Spectroscopy to Study Intermittent Dynamics

Sarcia, Regis; Hebraud, Pascal; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 60-62; In English; See also 20040086587; No Copyright; Avail: CASI; A01, Hardcopy

A new scheme of diffusing-wave spectroscopy is used to study the intermittent dynamics that occurs when a concentrated suspension flocculates. Crackling events are detected and their statistical properties analyzed. Many concentrated systems share common dynamical properties. Their dynamics exhibit two distinct characteristic times: the slowest is associated with the structural reorganization of the microscopic components. It generally increases when time flows: the system ages. Moreover, recent experiments have shown that this slow relaxation time exhibits intermittent dynamics when the system ages. We are here interested in the dynamics of a concentrated colloidal suspension. In the case where inter-particles interactions become attractive, the system flocculates, and the intermittent dynamics effects are enhanced. We thus develop a new diffusing

light scheme to analyze the statistical properties of these experiments. In the first part we present a multispeckle diffusing wave spectroscopy experiment in which fluctuations of diffused light are fully computed. We introduce a past-future representation in which intermittency naturally appears. Applying this technique to the flocculation of concentrated suspensions, we show the existence of crackling events, whose dynamics we characterize.
Author
Diffusion Waves; Spectroscopy; Dynamic Characteristics; Intermittency

20040086610 Chernivtsi State Univ., Chernivtsi, Ukraine
Fractal Structure of Biotissues Polarization Properties
Angelsky, O. V.; Ushenko, Y. G.; Ushenko, Y. A.; Ushenko, A. G.; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 72-74; In English; See also 20040086587; No Copyright; Avail: CASI; A01, Hardcopy

The interconnection between geometry of biotissue structure with their polarization properties has been studied. It has been shown that fractal character of polarization properties of physiologically normal biotissue transforms into a multifractal for a pathologically changed one.
Author
Fractals; Tissues (Biology); Polarization; Physiology; Human Pathology; Vectors (Mathematics)

20040086611 Chernivtsi State Univ., Chernivtsi, Ukraine
2-D Stokes-Correlometry of Biotissues Images in Pre-Clinic Diagnostics of Their Pre-Cancer States
Angelsky, O. V.; Ushenko, Y. G.; Ushenko, Y. A.; Ushenko, A. G.; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 75-77; In English; See also 20040086587; No Copyright; Avail: CASI; A01, Hardcopy

This research is directed to combine the possibilities of polarization-sensitive OCT (PSOCT) of biotissue (BT) with correlation method of analysis of 2-D parameters of Stokes vector of object fields for early diagnostics of pre-tumour changes of connective tissue (CT).
Author
Cancer; Connective Tissue; Diagnosis; Stokes Theorem (Vector Calculus); Correlation; Images; Polarization

20040086612 Chernivtsi State Univ., Chernivtsi, Ukraine
Estimation of Optical-Geometrical Parameters of Nonspherical Particles in Polarized Light
Podkamen, L. I.; Arkhelyuk, A. D.; Arkhelyuk, O. O.; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 99-101; In English; See also 20040086587; No Copyright; Avail: CASI; A01, Hardcopy

The experimental investigation results of the influence of the shape, size and orientation degree of nonspherical particles of the model pattern on the change regularities of normalized components of scattering and extinction matrixes are presented. The component of light field and experimental situations which are most advisable for the estimation of particles optical-geometrical parameters is obtained. Change regularities of the energetic and polarizing characteristics of the light crossed through the light beam depending on its optical-geometrical parameters can be fully described using the vector-parametrical principle of light beams and their linear transformation as a matrix.
Author
Polarized Light; Shapes; Particles

20040086616 FOM-Inst. voor Atoom- en Molecuulfysica, Amsterdam, Netherlands
Smectic Membranes in Motion: The Limits of X-Ray Photon Correlation Spectroscopy
deJeu, Wim H.; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 49; In English; See also 20040086587; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

In the first part I shall summarize results we reported recently of low-dimensional fluctuations in smectic liquid crystal membranes in the range of 10 nanoseconds to 10 microseconds using both x-ray photon correlation spectroscopy (XPCS) and neutron spin echo (NSE). XPCS probes surface tension-dominated relaxation times. In this regime, fluctuations with long wavelengths reveal an oscillatory damping, while fluctuations with a shorter wavelength show a simple exponential decay. NSE reveals a new regime, determined by bulk elasticity, in which the fast relaxation times decrease with the wave vector. In the second part I will discuss several practical aspects and limitations we encountered during our XPCS studies. Coherence effects differ from the situation in classical dynamic light scattering and can influence the time dependence of the correlation function. Variation of the detector slits as well as of the projected coherence length on the membrane induces a change in the

correlation a time. Finally heterodyne detection occurring at the specular ridge and homodyne detection at off-specular positions, will be discussed.
Author
Correlation; Photons; Spectroscopy; X Rays; Membranes

20040086618 University of Central Florida, Orlando, FL, USA
Higher-Order Correlations in Speckle Fields
Dogariu, A.; Ellis, J.; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 81-82; In English; See also 20040086587; No Copyright; Avail: CASI; A01, Hardcopy

We show that the joint probability distribution of polarization information and the complex degree of mutual polarization can be used to differentiate between different highly scattering media which depolarize the light in a global sense.
Author
Correlation; Probability Theory; Speckle Patterns; Optical Polarization

20040086621 Moscow State Univ., Russia
Giant Third-Harmonic Generation in Silver Nanoparticles: New Type of Hyper-Rayleigh Scattering
Aktsipetrov, O. A.; Elovikov, S. S.; Kim, E. M.; Bader, M. A.; Marowsky, G.; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 40-42; In English; See also 20040086587; No Copyright; Avail: CASI; A01, Hardcopy

Observation of surface-enhanced nonlinear optical effects in silver island films traces back to the early 1980's when surface-enhanced optical second-harmonic generation (SHG) and surface-enhanced Raman scattering where observed in the silver island films. The enhancement of the SHG intensity up to three orders of magnitude was attributed to the resonant enhancement of local field factor at the SHG wavelength mediated by local surface plasmon excitation in silver nanoparticles. Important aspect of the surface-enhanced SHG from the silver island films is the strong incoherency of the SHG radiation, which manifest itself throw the strong diffuseness and depolarization of the SHG radiation. The silver island films being 2-D random arrays of randomly shaped nanoparticles possess the spatial fluctuations of the second-order nonlinear susceptibility and local optical field factors. These result in fluctuations of quadratic nonlinear polarization, which are the sources of incoherent SHG, in other words the second-order hyper-Rayleigh scattering (HRS) at the SH wavelength. Strongly enhanced and diffuse SHG from rough silver films has been intensively studied since early 1980 s. In this paper, giant incoherent optical third-harmonic generation (THG) is observed in silver island films. The THG intensity from two-dimensional random array of silver nanoparticles is enhanced by two orders of magnitude. This enhancement is attributed to the local field resonance at third-harmonic wavelength mediated by excitation of the local surface plasmons in silver nanoparticles. Giant THG observed is strongly diffused and depolarized, which is clear manifestation of the third-order hyper-Rayleigh scattering in 2-D random ensemble of silver nanoparticles. Silver films were prepared by thermal evaporating, at a rate of 3-4 A/s, in vacuum of 10(exp -5) Torr onto substrate of silicon Si(001) wafers. Silicon wafers are used as substrate for almost ideal flatness of its surface. Silver films are characterized by mass thickness. Two types of samples are used in the nonlinear optical experiments: the silver island film samples with mass thickness of approximately 1 nm and thick homogeneous silver films with mass thickness of 40 nm.
Author (revised)
Harmonic Generations; Silver; Nanoparticles; Rayleigh Scattering; Metal Films

20040086623 Chernivtsi State Univ., Chernivtsi, Ukraine
The Role of Caustics in Formation of Network of Amplitude Zeroes for Partially Developed Speckle Field
Angelsky, O. V.; Maksimyak, P. P.; Maksimyak, A. P.; Hanson, S. G.; Ushenko, Y. A.; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 93-96; In English; See also 20040086587; No Copyright; Avail: CASI; A01, Hardcopy

The topology of a partially developed speckle field is studied using interference techniques. It has been shown that formation of interference forklets in the field gives evidence of changes in the field topology, being the diagnostic sign of transition from a planar Fraunhofer diffraction pattern to a three-dimensional pattern of a diffraction catastrophe.
Author
Topology; Diffraction Patterns; Speckle Patterns

20040086734 NASA Langley Research Center, Hampton, VA, USA
THUNDER Piezoelectric Actuators as a Method of Stretch-Tuning an Optical Fiber Grating
Allison, Sidney G.; Fox, Robert L.; Froggatt, Mark E.; Childers, Brooks A.; [2000]; 10 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

A method of stretching optical fiber holds interest for measuring strain in smart structures where the physical displacement may be used to tune optical fiber lasers. A small, light weight, low power tunable fiber laser is ideal for demodulating strain in optical fiber Bragg gratings attached to smart structures such as the re-usable launch vehicle that is being developed by NASA. A method is presented for stretching optical fibers using the THUNDER piezoelectric actuators invented at NASA Langley Research Center. THUNDER actuators use a piezoelectric layer bonded to a metal backing to enable the actuators to produce displacements larger than the unbonded piezoelectric material. The shift in reflected optical wavelength resulting from stretching the fiber Bragg grating is presented. Means of adapting THUNDER actuators for stretching optical fibers is discussed, including ferrules, ferrule clamp blocks, and plastic hinges made with stereo lithography.
Author
Optical Fibers; Piezoelectric Actuators; Strain Measurement; Bragg Gratings

20040086811 NASA Langley Research Center, Hampton, VA, USA
A Deployable Primary Mirror for Space Telescopes
Lake, Mark S.; Phelps, James E.; Dyer, Jack E.; Caudle, David A.; Tam, Anthony; Escobedo, Javier; Kasl, Eldon P.; [1999]; 13 pp.; In English; 1999 SPIE International Symposium on Optical Science, Engineering and Instrumentation, 18-23 Jul. 1999, Denver, CO, USA
Report No.(s): SPIE Paper 3785-02; Copyright; Avail: CASI; A03, Hardcopy
NASA Langley Research Center, Composite Optics, Inc., and Nyma/ADF have developed jointly a deployable primary mirror for space telescopes that combines over five years of research on deployment of optical-precision structures and over ten years of development of fabrication techniques for optical-precision composite mirror panels and structures. The deployable mirror is directly applicable to a broad class of non-imaging ‘lidar’ (light direction a nd ranging) telescopes whose figure-error requirements are in the range of one to ten microns RMS. Furthermore, the mirror design can be readily modified to accommodate imaging-quality reflector panels and active panel-alignment control mechanisms for application to imaging telescopes. The present paper: 1) describes the deployable mirror concept; 2) explains the status of the mirror development; and 3) provides some technical specifications for a 2.55- m-diameter, proof-of-concept mirror. Keywords: precision deployment, hinge joint, latch joint, deployable structures, fabrication, space telescopes, optical instruments, microdynamics.
Author
Spaceborne Telescopes; Mirrors; Optical Equipment; Imaging Techniques; Composite Structures; Fabrication

20040095307 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Optical Modeling Activities for the James Webb Space Telescope (JWST) Project, II, Determining Image Motion and Wavefront Error Over an Extended Field of View with a Segmented Optical System
Howard, Joseph M.; Ha, Kong Q.; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only
This is part two of a series on the optical modeling activities for JWST. Starting with the linear optical model discussed in part one, we develop centroid and wavefront error sensitivities for the special case of a segmented optical system such as JWST, where the primary mirror consists of 18 individual segments. Our approach extends standard sensitivity matrix methods used for systems consisting of monolithic optics, where the image motion is approximated by averaging ray coordinates at the image and residual wavefront error is determined with global tip/tilt removed. We develop an exact formulation using the linear optical model, and extend it to cover multiple field points for performance prediction at each instrument aboard JWST. This optical model is then driven by thermal and dynamic structural perturbations in an integrated modeling environment. Results are presented.
Author
James Webb Space Telescope; Models; Optical Activity; Image Motion Compensation; Wave Fronts; Errors

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PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20040086146 Pennsylvania State Univ., University Park, PA
Experimental Study of Plasma/Propellant Interactions
Thynell, Stefan T.; Litzinger, Thomas A.; Apr. 23, 2004; 30 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAG55-98-1-0519
Report No.(s): AD-A424481; ARO-39074.1-EG; No Copyright; Avail: CASI; A03, Hardcopy

The overall objective of the project was to improve our understanding of the various chemical and physical processes that occur during ignition by the plasma igniter. During the project period, electrical circuits, experimental setups were designed and manufactured, as well as data acquisition systems were acquired. The following primary findings have been obtained from this project: 1) to achieve ignition, a closed chamber configuration is needed, 2) JA2 propellant is readily ignitable, whereas nitramine-composite propellants show a two-stage mass generation behavior, 3) recovered samples from JA2 show changes in surface and sub- surface structure, in-depth melting, vaporization and chemical reactions, 4) recombination rates among plasma species are high, resulting in measurement of hydrocarbons at the surface having molecular weights from 1 to about 30 (H, H2, C, CH, CH2, etc.) and primarily NO, HCO and H2CO from propellants, 5) the radiative heat flux reaches a maximum when the electrical power conversion reaches a maximum, 6) the UV component is significant, and 7) the near-surface emission from the plasma is significantly reduced compared to peak values due to plasma expansion and to rapid heat losses by radiation.
DTIC
Charge Coupled Devices; Gun Propellants; High Speed Cameras; Ignition; Plasma Interactions; Pressure Measurement; Propellants; Time Lag

20040086919 NASA Ames Research Center, Moffett Field, CA, USA
Modeling of Sheath Ion-Molecule Reactions in Plasma Enhanced Chemical Vapor Deposition of Carbon Nanotubes
Hash, David B.; Govindan, T. R.; Meyyappan, M.; June 10, 2004; 1 pp.; In English; 57th Gaseous Electronics Conference, 26-29 Sep. 2004, Bunratty, Ireland; No Copyright; Avail: Other Sources; Abstract Only

In many plasma simulations, ion-molecule reactions are modeled using ion energy independent reaction rate coefficients that are taken from low temperature selected-ion flow tube experiments. Only exothermic or nearly thermoneutral reactions are considered. This is appropriate for plasma applications such as high-density plasma sources in which sheaths are collisionless and ion temperatures 111 the bulk p!asma do not deviate significantly from the gas temperature. However, for applications at high pressure and large sheath voltages, this assumption does not hold as the sheaths are collisional and ions gain significant energy in the sheaths from Joule heating. Ion temperatures and thus reaction rates vary significantly across the discharge, and endothermic reactions become important in the sheaths. One such application is plasma enhanced chemical vapor deposition of carbon nanotubes in which dc discharges are struck at pressures between 1-20 Torr with applied voltages in the range of 500-700 V. The present work investigates The importance of the inclusion of ion energy dependent ion-molecule reaction rates and the role of collision induced dissociation in generating radicals from the feedstock used in carbon nanotube growth.
Author
Carbon Nanotubes; Vapor Deposition; Sheaths; Ionic Reactions; Molecular Interactions; Collisions; Plasmas (Physics)

20040089075 Princeton Univ., NJ
Grid-Based Parallel Data Streaming Implemented for the Gyrokinetic Toroidal Code
Klasky, S.; Ethier, S.; Lon, Z.; 2003; In English
Report No.(s): DE2003-815093; PPPL-3868; No Copyright; Avail: National Technical Information Service (NTIS)

We have developed a threaded parallel data streaming approach using Globus to transfer multi-terabyte simulation data from a remote supercomputer to the scientists home analysis/visualization cluster, as the simulation executes, with negligible overhead. Data transfer experiments show that this concurrent data transfer approach is more favorable compared with writing to local disk and then transferring this data to be post-processed. The present approach is conducive to using the grid to pipeline the simulation with post-processing and visualization. We have applied this method to the Gyrokinetic Toroidal Code (GTC), a 3-dimensional particle-in-cell code used to study micro-turbulence in magnetic confinement fusion from first principles plasma theory.
NTIS
Plasma Physics; Supercomputers

20040089328 Princeton Univ., NJ, USA
Three-Dimensional Neutral Transport Simulations of Gas Puff Imaging Experiments
Sep. 2003; In English
Report No.(s): DE2003-815148; PPPL-3875; No Copyright; Avail: National Technical Information Service (NTIS)

Gas Puff Imaging (GPI) experiments are designed to isolate the structure of plasma turbulence in the plane perpendicular to the magnetic field. Three-dimensional aspects of this diagnostic technique as used on the National Spherical Torus

eXperiment (NSTX) are examined via Monte Carlo neutral transport simulations. The radial width of the simulated GPI images are in rough agreement with observations. However, the simulated emission clouds are angled approximately 15 degrees with respect to the experimental images. The simulations indicate that the finite extent of the gas puff along the viewing direction does not significantly degrade the radial resolution of the diagnostic. These simulations also yield effective neutral density data that can be used in an approximate attempt to infer 2-D electron density and temperature profiles from the experimental images.
NTIS
Magnetic Fields; Neutral Gases; Temperature Profiles; Gas Transport

76
SOLID-STATE PHYSICS

Includes condensed matter physics, crystallography, and superconductivity. For related information see also *33 Electronics and Electrical Engineering*; and *36 Lasers and Masers*.

20040086177 Brown Univ., Providence, RI
Exploration of Highly-Ordered Carbon Nanotube Arrays for Infrared Detection
Xu, J. M.; Jan. 2004; 22 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0319; Proj-2305
Report No.(s): AD-A424556; AFRL-SR-AR-TR-04-0373; No Copyright; Avail: CASI; A03, Hardcopy

During the course of this project, we employed and extended our unique capability in template-growth of nanostructured materials, particularly carbon nanotubes. This fabrication capability formed the foundation for farther investigations, into the infra-red properties and transport properties of these nanostructures. We were able to fabricate large arrays of identical carbon nanotubes with identical properties, which enabled sufficient signal enhancement to perform novel infra-red spectroscopy studies on the nanotubes. Extensions of our core fabrication method enabled the creation of carbon nanotube arrays on silicon wafers. The importance of silicon as a semiconductor material cannot be overstated, and so the fabrication and measurements of these structures represents an important step toward integrated Si-CNT infrared detectors. The results of this project clearly demonstrate the feasibility of employing ordered carbon nanotube arrays in infra-red detection applications.
DTIC
Carbon Nanotubes; Infrared Detectors

20040086619 Chernivtsi State Univ., Chernivtsi, Ukraine
The Investigation of Chaos in the Field of Optical Radiation Scattered by Liquid Crystals
Gavrylyak, M. S.; Lomanets, V. S.; Maksimyak, P. P.; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 107-108; In English; See also 20040086587; No Copyright; Avail: CASI; A01, Hardcopy

This paper represents the results of investigating chaos in the field of optical radiation scattered by nematic liquid crystal during phase transition liquid - liquid crystal and liquid crystal - liquid. It has been shown that Lyapunov's maxim index of time intensity dependency is greater than zero, i.e. there is some chaos in the system.
Author
Chaos; Light Scattering; Liquid Crystals

20040086657 Iowa State Univ. of Science and Technology, Ames, IA, USA
SPA-LEED Study of the Morphology and Nucleation of a Novel Growth Mode and the 'Devil's Staircase' on Pb/Si(111)
Yeh, W. C. V.; 2003; 106 pp.; In English
Report No.(s): DE2004-822043; No Copyright; Avail: Department of Energy Information Bridge

This thesis was developed to address the following questions for the Pb/Si(111) system: (1) Is it possible to control the nano-structure growth by changing the initial substrate; (2) is the nucleation theory applicable to the case of the 7-step growth mode; and (3) what phase or phases could be formed between coverage 6/5 ML and 4/3 ML. The first question was answered in chapter 2, different growth results were observed for different initial substrate, suggesting the possibility of controlling nano-structure growth by selecting the initial substrate. The applicability of nucleation theory was determined to be unclear in chapter 3, from the results that the saturation island density does not depend on deposition rate, in contrary to the prediction of nucleation theory. Chapter 4 revealed a novel 'devil's staircase' in Pb/Si(111) within the coverage range 6/5 ML and 4/3 ML. Low temperature deposition experiments showed high order of self-organization in such a system. Theoretical studies are needed to understand such a low temperature behavior. In general, this thesis provides possibilities of controlling

nano-structure growth, which can be possibly an indication for future application. It also raises interesting questions in fundamental researches: a modified theory of nucleation is needed, and a detailed study of low temperature behavior is required. Details of the conclusions in each of the chapters are collected in the following sections.
NTIS
Nanostructure (Characteristics); Prediction Analysis Techniques; Lead (Metal); Silicon

20040086803 NASA Langley Research Center, Hampton, VA, USA
A Cryogenic Magnetostrictive Actuator using a Persistent High Temperature Superconducting Magnet, Part 1: Concept and Design, Part 1, Concept and Design
Horner, Garnett C.; Bromberg, Leslie; Teter, J. P.; [2001]; 7 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

Cryogenic magnetostrictive materials, such as rare earth zinc crystals, offer high strains and high forces with minimally applied magnetic fields, making the material ideally suited for deformable optics applications. For cryogenic temperature applications, such as Next Generation Space Telescope (NGST), the use of superconducting magnets offer the possibility of a persistent mode of operation, i.e., the magnetostrictive material will maintain a strain field without power. High temperature superconductors (HTS) are attractive options if the temperature of operation is higher than 10 degrees Kelvin (K) and below 77 K. However, HTS wires have constraints that limit the minimum radius of winding, and even if good wires can be produced, the technology for joining superconducting wires does not exist. In this paper, the design and capabilities of a rare earth zinc magnetostrictive actuator using bulk HTS is described. Bulk superconductors can be fabricated in the sizes required with excellent superconducting properties. Equivalent permanent magnets, made with this inexpensive material, are persistent, do not require a persistent switch as in HTS wires, and can be made very small. These devices are charged using a technique which is similar to the one used for charging permanent magnets, e.g., by driving them into saturation. A small normal conducting coil can be used for charging or discharging. Very fast charging and discharging of HTS tubes, as short as 100 microseconds, has been demonstrated. Because of the magnetic field capability of the superconductor material, a very small amount of superconducting magnet material is needed to actuate the rare earth zinc. In this paper, several designs of actuators using YBCO and BSCCO 2212 superconducting materials are presented. Designs that include magnetic shielding to prevent interaction between adjacent actuators will also be described. Preliminary experimental results and comparison with theory for BSSCO 2212 with a magnetostrictive element will be discussed.
Author
Actuators; Cryogenics; Magnetostriction; Superconducting Magnets; Design Analysis

20040086907 NASA Ames Research Center, Moffett Field, CA, USA
Modeling Growth of Nanostructures in Plasmas
Hwang, Helen H.; Bose, Deepak; Govindan, T. R.; Meyyappan, M.; [2004]; 1 pp.; In English; 57th Annual Gaseous Electronics Conference, 26-29 Sep. 2004, Bunratty, Ireland
Contract(s)/Grant(s): 302-05-42; No Copyright; Avail: Other Sources; Abstract Only

As semiconductor circuits shrink to CDs below 0.1 nm, it is becoming increasingly critical to replace and/or enhance existing technology with nanoscale structures, such as nanowires for interconnects. Nanowires grown in plasmas are strongly dependent on processing conditions, such as gas composition and substrate temperature. Growth occurs at specific sites, or step-edges, with the bulk growth rate of the nanowires determined from the equation of motion of the nucleating crystalline steps. Traditional front-tracking algorithms, such as string-based or level set methods, suffer either from numerical complications in higher spatial dimensions, or from difficulties in incorporating surface-intense physical and chemical phenomena. Phase field models have the robustness of the level set method, combined with the ability to implement surface-specific chemistry that is required to model crystal growth, although they do not necessarily directly solve for the advancing front location. We have adopted a phase field approach and will present results of the adatom density and step-growth location in time as a function of processing conditions, such as temperature and plasma gas composition.
Author
Nanostructures (Devices); Plasmas (Physics); Mathematical Models; Crystal Growth; Quantum Wires

20040086920 NASA Ames Research Center, Moffett Field, CA, USA
Numerical Simulation of Nanostructure Growth
Hwang, Helen H.; Bose, Deepak; Govindan, T. R.; Meyyappan, M.; [2004]; 1 pp.; In English; AVS 51st International Symposium, 14-19 Nov. 2004, Anaheim, CA, USA
Contract(s)/Grant(s): 21-302-05-42; No Copyright; Avail: Other Sources; Abstract Only

Nanoscale structures, such as nanowires and carbon nanotubes (CNTs), are often grown in gaseous or plasma environments. Successful growth of these structures is defined by achieving a specified crystallinity or chirality, size or diameter, alignment, etc., which in turn depend on gas mixture ratios. pressure, flow rate, substrate temperature, and other operating conditions. To date, there has not been a rigorous growth model that addresses the specific concerns of crystalline nanowire growth, while demonstrating the correct trends of the processing conditions on growth rates. Most crystal growth models are based on the Burton, Cabrera, and Frank (BCF) method, where adatoms are incorporated into a growing crystal at surface steps or spirals. When the supersaturation of the vapor is high, islands nucleate to form steps, and these steps subsequently spread (grow). The overall bulk growth rate is determined by solving for the evolving motion of the steps. Our approach is to use a phase field model to simulate the growth of finite sized nanowire crystals, linking the free energy equation with the diffusion equation of the adatoms. The phase field method solves for an order parameter that defines the evolving steps in a concentration field. This eliminates the need for explicit front tracking/location, or complicated shadowing routines, both of which can be computationally expensive, particularly in higher dimensions. We will present results demonstrating the effect of process conditions, such as substrate temperature, vapor supersaturation, etc. on the evolving morphologies and overall growth rates of the nanostructures.
Author
Crystallinity; Nanostructure Growth; Simulation; Numerical Analysis

20040087396 National Renewable Energy Lab., Golden, CO, Toledo Univ., OH, USA
High Efficiency Thin Film CdTe and a-Si Based Solar Cells
Compaan, A. D.; Deng, X.; Bohn, R. G.; 2003; In English
Report No.(s): DE2003-15004829; NRELSR-520-34822; No Copyright; Avail: National Technical Information Service (NTIS)

This is the final report covering approximately 42 months of this subcontract for research on high efficiency CdTe-based thin-film solar cells and on high efficiency a-Si-based thin-film solar cells. Phases I and II have been extensively covered in two Annual Reports. For this Final Report, highlights of the first two Phases will be provided and then detail will be given on the last year and a half of Phase III.
NTIS
Thin Films; Solar Cells; Solar Energy

20040090467 National Renewable Energy Lab., Golden, CO, Northwestern Univ., Evanston, IL
Improved Transparent Conducting Oxides for Photovoltaics
Mason, T. O.; Chang, R. P. H.; Marks, T. J.; Poeppelmeier, K. R.; 2003; In English
Report No.(s): DE2003-15004838; NREL/SR-520-34825; No Copyright; Avail: National Technical Information Service (NTIS)

This subcontract focused on next-generation transparent conducting oxides (TCOs) for improved PV performance. More specifically, there were two research foci- 1) improved Sn-based, n-type TCOs aimed at enhanced CdTe PV cell performance, and 2) novel Cu-based, p-type TCOs applicable to a variety of PV designs. The objective of the research under this subcontract was to identify, explore, evaluate, and develop future generations of photovoltaic technologies that can meet the long term goal of producing low-cost electricity from sunlight. A combination of bulk and thin film studies was employed to discover, synthesize, characterize, and optimize novel TCO phases in promising Cd/Sn-based and Cu-based systems.
NTIS
Conductivity; Thin Films; Photovoltaic Conversion

77
PHYSICS OF ELEMENTARY PARTICLES AND FIELDS

Includes quantum mechanics; theoretical physics; and statistical mechanics. For related information see also *72 Atomic and Molecular Physics, 73 Nuclear Physics*, and *25 Inorganic, Organic and Physical Chemistry*.

20040086591 Kansas State Univ., Manhattan, KS, USA
A Fuzzy Simultaneous Measurement of Two Polarization Vector Components
Shepard, Scott Roger; 2004 Photon Correlation and Scattering Conference; August 2004, pp. 69-71; In English; See also 20040086587; No Copyright; Avail: CASI; A01, Hardcopy

We derive a measurement associated with the angular momentum lowering operator, which describes a simultaneous (yet,

realizable) measurement of two non-commuting spin vector components. Correlations between two such detectors are also discussed.
Author
Fuzzy Systems; Polarization; Vectors (Mathematics); Detectors; Quantum Mechanics

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20040086558 NASA Langley Research Center, Hampton, VA, USA
Do-It-Yourself: A Special Library's Approach to Creating Dynamic Web Pages Using Commercial Off-The-Shelf Applications
Steeman, Gerald; Connell, Christopher; [2000]; 13 pp.; In English; 21st Annual National Online Meeting, 16-18 May 2000, New York City, NY, USA; No Copyright; Avail: CASI; A03, Hardcopy

Many librarians may feel that dynamic Web pages are out of their reach, financially and technically. Yet we are reminded in library and Web design literature that static home pages are a thing of the past. This paper describes how librarians at the Institute for Defense Analyses (IDA) library developed a database-driven, dynamic intranet site using commercial off-the-shelf applications. Administrative issues include surveying a library users group for interest and needs evaluation; outlining metadata elements; and, committing resources from managing time to populate the database and training in Microsoft FrontPage and Web-to-database design. Technical issues covered include Microsoft Access database fundamentals, lessons learned in the Web-to-database process (including setting up Database Source Names (DSNs), redesigning queries to accommodate the Web interface, and understanding Access 97 query language vs. Standard Query Language (SQL)). This paper also offers tips on editing Active Server Pages (ASP) scripting to create desired results. A how-to annotated resource list closes out the paper.
Author
Computer Networks; Data Bases; Websites

20040086930 NASA Langley Research Center, Hampton, VA, USA
Goals Analysis Procedure Guidelines for Applying the Goals Analysis Process
Motley, Albert E., III; [2000]; 12 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

One of the key elements to successful project management is the establishment of the 'right set of requirements", requirements that reflect the true customer needs and are consistent with the strategic goals and objectives of the participating organizations. A viable set of requirements implies that each individual requirement is a necessary element in satisfying the stated goals and that the entire set of requirements, taken as a whole, is sufficient to satisfy the stated goals. Unfortunately, it is the author's experience that during project formulation phases' many of the Systems Engineering customers do not conduct a rigorous analysis of the goals and objectives that drive the system requirements. As a result, the Systems Engineer is often provided with requirements that are vague, incomplete, and internally inconsistent. To complicate matters, most systems development methodologies assume that the customer provides unambiguous, comprehensive and concise requirements. This paper describes the specific steps of a Goals Analysis process applied by Systems Engineers at the NASA Langley Research Center during the formulation of requirements for research projects. The objective of Goals Analysis is to identify and explore all of the influencing factors that ultimately drive the system's requirements.
Author
Project Management; Goal Theory; Systems Engineering

20040087214 NASA Ames Research Center, Moffett Field, CA, USA
Zero to Sixty with Design-by-Prototype: How to Move Quickly in Product Development by Holding off on Design
Mulenburg, Gerald M.; [2004]; 15 pp.; In English; International Institute for Research-Product Management and Development Association, Managing the Front End of Innovation Conference, 24-26 May 2004, Boston, MA, USA; No Copyright; Avail: CASI; A03, Hardcopy

I'm going to cover four issues to emphasize why design-by-prototype has significant value: 1) We start too soon and end

too late; 2) If you don't know where you're going, go there! 3) Iteration is not a dirty word, it's how we learn; 4) Experts at fabrication know how to design better.
Derived from text
Product Development; Rapid Prototyping

20040090497 Nebraska Univ., Omaha, NE, USA, NASA Langley Research Center, Hampton, VA, USA
Overview: Small Aircraft Transportation System Airborne Remote Sensing Fuel Droplet Evaporation
Bowen, Brent, Editor; Holmes, Bruce; Gogos, George; Narayanan, Ram; Smith, Russell; Woods, Sara; January 2004; 10 pp.; In English
Contract(s)/Grant(s): NCC5-572
Report No.(s): UNOIA-Monograph-00-1; No Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

The NASA Nebraska Preparation Grant was designed to solidify relationships, intensify communication, and launch collaborative initiatives among Nebraska researchers and key contacts at NASA research centers and enterprises. In doing so, Nebraska was successful in laying the groundwork for the foundation for numerous long-term, mutually beneficial collaborations that were subsequently proposed and awarded in the NASA EPSCoR 2000 competition. The NASA Nebraska EPSCoR Preparation Grant was managed by the same administrative team that oversees Nebraska's NASA Space Grant and EPSCoR programs. An advisory board (later Technical Advisory Committee) made up of voting representatives from all affiliate and partner organizations regularly reviewed grant progress and direction. The University of Nebraska at Omaha's Aviation Institute, the host institution for all three programs, provided additional administrative oversight and program evaluation through established review mechanisms. This structure has served NASA well and has been cited as a model program. The second year of preparation grant funding served as a significant opportunity for Nebraska to lay the groundwork for the continued elevation and success of its NASA EPSCoR program. In anticipation of the NASA EPSCoR 2000 grant competition, Year 2 funding enabled funded researchers to further broaden and enhance the quality and quantity of collaborations with NASA Field Centers, Codes, and Enterprises. The plan set the stage for long-term research and outreach endeavors that have contributed significantly to the achievement of NASA's strategic objectives; the state of Nebraska's economic and aerospace development efforts; and have advanced Nebraska s aeronautics research efforts to a national leadership level. The overarching goal of the NASA Nebraska EPSCoR Preparation grant was met by facilitating research endeavors among Nebraska faculty that addressed research and technology priorities of the NASA Field Centers, Codes, and Strategic Enterprises. During the first year of funding, Nebraska established open and frequent lines of communication with university affairs officers and other key personnel at all NASA Centers and Enterprises, and facilitated the development of collaborations between and among junior faculty in the state and NASA researchers. As a result, Nebraska initiated a major research cluster, the Small Aircraft Transportation System Nebraska Implementation Template.
Derived from text
Management Planning; Research and Development; Transportation; Remote Sensing; Leadership; Evaporation

20040090599 NASA Langley Research Center, Hampton, VA, USA
Charting Multidisciplinary Team External Dynamics Using a Systems Thinking Approach
Barthelemy, Jean-Francois; Waszak, Martin R.; Jones, Kenneth M.; Silcox, Richard J.; Silva, Walter A.; Nowaczyk, Ronald H.; [1998]; 12 pp.; In English; 7th AIAA/USAF/NASA/ISSMO Symposium on Multidisciplinary Analysis and Optimization, 2-4 Sep. 1998, Saint Louis, MO, USA
Report No.(s): AIAA Paper 98-4939; Copyright; Avail: CASI; A03, Hardcopy

Using the formalism provided by the Systems Thinking approach, the dynamics present when operating multidisciplinary teams are examined in the context of the NASA Langley Research and Technology Group, an R&D organization organized along functional lines. The paper focuses on external dynamics and examines how an organization creates and nurtures the teams and how it disseminates and retains the lessons and expertise created by the multidisciplinary activities. Key variables are selected and the causal relationships between the variables are identified. Five 'stories' are told, each of which touches on a different aspect of the dynamics. The Systems Thinking Approach provides recommendations as to interventions that will facilitate the introduction of multidisciplinary teams and that therefore will increase the likelihood of performing successful multidisciplinary developments. These interventions can be carried out either by individual researchers, line management or program management.
Author
Formalism; Project Management; Management Systems

20040090609 NASA Langley Research Center, Hampton, VA, USA

Modeling and Analysis of Multidiscipline Research Teams at NASA Langley Research Center: A Systems Thinking Approach

Waszak, Martin R.; Barthelemy, Jean-Francois; Jones, Kenneth M.; Silcox, Richard J.; Silva, Walter A.; Nowaczyk, Ronald H.; [1998]; 12 pp.; In English; Seventh AIAA/USAF/NASA/ISSMO Symposium on Multidisciplinary Analysis and Optimization, 2-4 Sep. 1998, Saint Louis, MO, USA

Report No.(s): AIAA Paper 98-4940; Copyright; Avail: CASI; A03, Hardcopy

Multidisciplinary analysis and design is inherently a team activity due to the variety of required expertise and knowledge. As a team activity, multidisciplinary research cannot escape the issues that affect all teams. The level of technical diversity required to perform multidisciplinary analysis and design makes the teaming aspects even more important. A study was conducted at the NASA Langley Research Center to develop a model of multidiscipline teams that can be used to help understand their dynamics and identify key factors that influence their effectiveness. The study sought to apply the elements of systems thinking to better understand the factors, both generic and Langley-specific, that influence the effectiveness of multidiscipline teams. The model of multidiscipline research teams developed during this study has been valuable in identifying means to enhance team effectiveness, recognize and avoid problem behaviors, and provide guidance for forming and coordinating multidiscipline teams.

Author

Multidisciplinary Research; Models

20040090626 NASA Langley Research Center, Hampton, VA, USA

Factors Related to Successful Engineering Team Design

Nowaczyk, Ronald H.; Zang, Thomas A.; [1998]; 9 pp.; In English

Contract(s)/Grant(s): NAS1-19480

Report No.(s): AIAA Paper 98-4941; Copyright; Avail: CASI; A02, Hardcopy

The perceptions of a sample of 49 engineers and scientists from NASA Langley Research Center toward engineering design teams were evaluated. The respondents rated 60 team behaviors in terms of their relative importance for team success. They also completed a profile of their own perceptions of their strengths and weaknesses as team members. Behaviors related to team success are discussed in terms of those involving the organizational culture and commitment to the team and those dealing with internal team dynamics. The latter behaviors included the level and extent of debate and discussion regarding methods for completing the team task and the efficient use of team time to explore and discuss methodologies critical to the problem. Successful engineering teams may find their greatest challenges occurring during the early stages of their existence. In contrast to the prototypical business team, members on an engineering design share expertise and knowledge which allows them to deal with task issues sooner. However, discipline differences among team members can lead to conflicts regarding the best method or approach to solving the engineering problem.

Author

Engineers; Perception; Time Dependence; Management Analysis

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DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer program documentation see *61 Computer Programming and Software*.

20040085744 NASA Langley Research Center, Hampton, VA, USA

OAI and NASA's Scientific and Technical Information

Nelson, Michael L.; Rocker, JoAnne; Harrison, Terry L.; [2002]; 21 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

The Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH) is an evolving protocol and philosophy regarding interoperability for digital libraries (DLs). Previously, 'distributed searching' models were popular for DL interoperability. However, experience has shown distributed searching systems across large numbers of DLs to be difficult to maintain in an Internet environment. The OAI-PMH is a move away from distributed searching, focusing on the arguably simpler model of 'metadata harvesting". We detail NASA s involvement in defining and testing the OAI-PMH and experience to date with adapting existing NASA distributed searching DLs (such as the NASA Technical Report Server) to use the OAI-PMH and metadata harvesting. We discuss some of the entirely new DL projects that the OAI-PMH has made

possible, such as the Technical Report Interchange project. We explain the strategic importance of the OAI-PMH to the mission of NASA s Scientific and Technical Information Program.
Author
Protocol (Computers); Documents; Information Dissemination

20040086124 Kentucky Univ., Lexington, KY
Enhancing Process and Data Collection Efficiency of Peripherally Inserted Central Catheter Insertion for Justification of an Intravenous Access Program
Mansuy, John L.; Jun. 21, 2004; 23 pp.; In English
Report No.(s): AD-A424429; CI04-388; No Copyright; Avail: CASI; A03, Hardcopy

This purpose of this paper is to describe the optimizing Peripherally Inserted Central Catheter (PICC) insertion, revising data collection strategies, estimating workloads, and calculating the financial savings generated by the vascular access nurse (VAN). The data gathered will be used in a proposal to start an Intravascular Access Program (IAP).
DTIC
Blood Vessels; Cardiovascular System; Catheterization; Data Acquisition; Data Processing; Intravenous Procedures; Medical Equipment

20040086149
Building a Global Database of Beaked Whale Occurrence and Distribution
MacLeod, Colin D.; Dec. 2002; 4 pp.; In English
Contract(s)/Grant(s): N00014-020109253
Report No.(s): AD-A424484; No Copyright; Avail: CASI; A01, Hardcopy

To investigate the occurrence and distribution of beaked whales throughout the world's oceans and identify known hotspots for beaked whales.
DTIC
Data Bases; Whales

20040086181 Naval Postgraduate School, Monterey, CA
Foreign Military Sales Pricing Principles for Electronic Technical Manuals
Person, Lester B.; Thomas, Terrance L.; Jun. 2004; 57 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424562; No Copyright; Avail: CASI; A04, Hardcopy

DOD Instruction 7000.14-R, paragraph 0716, prescribes the methods that will be used to determine the price of DOD publications when they are sold to foreign military sales (FMS) customers. The Instruction includes publication pricing factors that shall be included in the development of FMS prices for paper publications. When technical data was maintained and distributed primarily by paper form, pricing the product to recover the associated costs was a relatively reasonable and reliable process. As we transition from paper to electronic data encompassed in various media and arrangements, the costs associated with this migration will differ considerably. As electronic storage and presentation of digital data becomes more interactive with the internet, the association between the existing practices and advanced products become more contradictory. The historical pricing procedures will no longer reflect the costs that need to be recovered. In this era of digital data and computerized integration, new technological advances have increased the demand and cost of services associated with digitization of paper documents. With the introduction of these new technologies, various fees associated with this transformation have to be incorporated into the pricing structure that currently exists. The problem that exists with the incorporation of these fees is the lack of long-term historical data due to relative infancy of the goods and services linked to this technology. The primary objective of this project is to determine accurate and justifiable pricing for the foreign military sale of electronic technical manuals under the guiding principles of DOD Instruction 7000.14-R. is for the abstract
DTIC
Manuals

20040086210 Naval Postgraduate School, Monterey, CA
Live from the Battlefield: An Examination of Embedded War Correspondents' Reporting during Operation Iraqi Freedom (21 March-14 April 2003)
Mooney, Michael J.; Jun. 2004; 185 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424638; No Copyright; Avail: CASI; A09, Hardcopy

During Operation Iraqi Freedom (OIF), the U.S. Department of Defense instituted a program to attach civilian journalists to coalition military units. Their purpose was to report firsthand on the military campaign to topple Saddam Hussein. These 'embedded journalists,' as they were called, would travel, eat, sleep, and endure the same hardships and dangers of the soldiers and Marines they were accompanying. While their immediate and highly dramatic accounts offered a perspective not before seen by the news-hungry U.S. public, they also raised questions about whether the 'embedding' process resulted in a more thematically narrow coverage of the war. This study addresses the newspaper coverage of OIF by examining the content of the embedded and non-embedded war reporting of various highly circulating U.S. newspapers. It is posited that being attached or embedded with U.S. military units resulted in journalists producing a body of stories concerning military operations and personnel that was markedly different from the stories of non-embedded reporters during OIF. (15 tables, 104 refs.)
DTIC
Embedding; Iraq; News Media; Warfare

20040086268 Naval Postgraduate School, Monterey, CA
Strategies to Build a Trusted and Collaborative Information Sharing System for State-Level Homeland Security
Flowers, Robert L.; Jun. 2004; 67 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424732; No Copyright; Avail: CASI; A04, Hardcopy

At all levels of government, strategies to prevent terrorism will rely on the development and distribution of actionable information. It is essential that the USA strengthen its capacity to gather, share, analyze and disseminate such information. In the State of Utah, however, these efforts have been jeopardized by a failure to adequately understand the cultural impediments to building more effective information systems. Spending more money on 'stuff' (hardware, communications systems, etc.) will not provide for better information sharing, unless cultural barriers to change are recognized and taken into account in State planning. Public safety officers in Utah are, in my experience, extremely dedicated and competent public servants. Nevertheless, the top priority in Utah should be building a new culture where trust and collaboration exist among the organizations involved in homeland security. This thesis argues that such collaboration does not exist today, and will not grow naturally on its own. Further, states such as Utah need to develop and implement a strategic plan to build a culture of collaboration. This thesis proposed such a plan, tailored to overcome the specific problems that my research has uncovered.
DTIC
Information Systems; Safety; Security; Terrorism

20040086555 NASA Langley Research Center, Hampton, VA, USA
Metadata and Buckets in the Smart Object, Dumb Archive (SODA) Model
Nelson, Michael L.; Maly, Kurt; Croom, Delwin R., Jr.; Robbins, Steven W.; [2004]; 11 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

We present the Smart Object, Dumb Archive (SODA) model for digital libraries (DLs), and discuss the role of metadata in SODA. The premise of the SODA model is to 'push down' many of the functionalities generally associated with archives into the data objects themselves. Thus the data objects become 'smarter", and the archives 'dumber". In the SODA model, archives become primarily set managers, and the objects themselves negotiate and handle presentation, enforce terms and conditions, and perform data content management. Buckets are our implementation of smart objects, and da is our reference implementation for dumb archives. We also present our approach to metadata translation for buckets.
Author
Data Management; Documents

20040086556 NASA Langley Research Center, Hampton, VA, USA
Preserving the Pyramid of STI Using Buckets
Nelson, Michael L.; Maly, Kurt; [2004]; 7 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

The product of research projects is information. Through the life cycle of a project, information comes from many sources and takes many forms. Traditionally, this body of information is summarized in a formal publication, typically a journal article. While formal publications enjoy the benefits of peer review and technical editing, they are also often compromises in media format and length. As such, we consider a formal publication to represent an abstract to a larger body of work: a pyramid of scientific and technical information (STI). While this abstract may be sufficient for some applications, an in-depth use or analysis is likely to require the supporting layers from the pyramid. We have developed buckets to preserve this pyramid of STI. Buckets provide an archive- and protocol-independent container construct in which all related information objects can be logically grouped together, archived, and manipulated as a single object. Furthermore, buckets are active archival objects

and can communicate with each other, people, or arbitrary network services. Buckets are an implementation of the Smart Object, Dumb Archive (SODA) DL model. In SODA, data objects are more important than the archives that hold them. Much of the functionality traditionally associated with archives is pushed down into the objects, such as enforcing terms and conditions, negotiating display, and content maintenance. In this paper, we discuss the motivation, design, and implication of bucket use in DLs with respect to grey literature.
Author
Documents; Information Systems

20040086643 NASA Langley Research Center, Hampton, VA, USA
SODA: Smart Objects, Dumb Archives
Nelson, Michael L.; Maly, Kurt; Zubair, Mohammad; Shen, Stewart N. T.; Proceedings of the Third European Conference on Research and Advanced Technology for Digital Libraries; [2004], pp. 453-464; In English; Third European Conference on Research and Advanced Technology for Digital Libraries, 22-24 Sep. 1999, Paris, France; No Copyright; Avail: CASI; A03, Hardcopy

We present the Smart Object, Dumb Archive (SODA) model for digital libraries (DLs). The SODA model transfers functionality traditionally associated with archives to the archived objects themselves. We are exploiting this shift of responsibility to facilitate other DL goals, such as interoperability, object intelligence and mobility, and heterogeneity. Objects in a SODA DL negotiate presentation of content and handle their own terms and conditions. In this paper we present implementations of our smart objects, buckets, and our dumb archive (DA). We discuss the status of buckets and DA and how they are used in a variety of DL projects.
Author
Libraries; Interoperability; Documents

20040086690 NASA Langley Research Center, Hampton, VA, USA
Smart Objects, Dumb Archives: A User-Centric, Layered Digital Library Framework
Maly, Kurt; Nelson, Michael L.; Zubair, Mohammad; D-Lib Magazine; March 1999; ISSN 1082-9873; Volume 5, No. 3; 17 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

Currently, there exist a large number of superb digital libraries, all of which are, unfortunately, vertically integrated and all presenting a monolithic interface to their users. Ideally, a user would want to locate resources from a variety of digital libraries dealing only with one interface. A number of approaches exist to this interoperability issue exist including: defining a universal protocol for all libraries to adhere to; or developing mechanisms to translate between protocols. The approach we illustrate in this paper is to push down the level of universal protocols to one for digital object communication and for communication for simple archives. This approach creates the opportunity for digital library service providers to create digital libraries tailored to the needs of user communities drawing from available archives and individual publishers who adhere to this standard. We have created a reference implementation based on the hyper text transfer protocol (http) with the protocols being derived from the Dienst protocol. We have created a special class of digital objects called buckets and a number of archives based on a NASA collection and NSF funded projects. Starting from NCSTRL we have developed a set of digital library services called NCSTRL+ and have created digital libraries for researchers, educators and students that can each draw on all the archives and individually created buckets.
Author
Interoperability; Libraries; Protocol (Computers); Pulse Communication; Information Retrieval

20040086756 NASA Langley Research Center, Hampton, VA, USA
The International Space Station As a Free Flyer Servicing Node
Antol, Jeffrey; Headley, David E.; [1999]; 5 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The International Space Station will provide a multitude of opportunities for an expanding customer base to make use of this international resource. One such opportunity is servicing of various visiting vehicles that are in a similar orbit to the station. Servicing may include change-out of payloads, replenishment of consumables, repair, and refurbishment operations. Previous studies have been conducted in which ‘paper’ free flyers have been assessed against the station s ability to accommodate them. Over the last several months though, an already flown free flyer, EURECA, was assessed as a real-life visiting free flyer design reference mission. Issues such as capture/berthing, servicing, logistics support, and stowage were assessed for station design and operational approaches. This paper will highlight critical visiting vehicle design considerations,

identify station issues, and provide recommendations for accommodation of a wide range of visiting vehicle requirements of the future.
Author
International Space Station; Logistics; Maintenance; Payloads; Replenishment

20040086770 NASA Langley Research Center, Hampton, VA, USA
Determining the Publication Impact of a Digital Library
Kaplan, Nancy R.; Nelson, Michael L.; Journal of the American Society for Information Science; 2000; Volume 51, No. 4, pp. 324-339; In English; Copyright; Avail: Other Sources

We attempt to assess the publication impact of a digital library (DL) of aerospace scientific and technical information (STI). The Langley Technical Report Server (LTRS) is a digital library of over 1,400 electronic publications authored by NASA Langley Research Center personnel or contractors and has been available in its current World Wide Web (WWW) form since 1994. In this study, we examine calendar year 1997 usage statistics of LTRS and the Center for AeroSpace Information (CASI), a facility that archives and distributes hard copies of NASA and aerospace information. We also perform a citation analysis on some of the top publications distributed by LTRS. We find that although LTRS distributes over 71,000 copies of publications (compared with an estimated 24,000 copies from CASI), citation analysis indicates that LTRS has almost no measurable publication impact. We discuss the caveats of our investigation, speculate on possible different models of usage facilitated by DLs , and suggest retrieval analysis as a complementary metric to citation analysis. While our investigation failed to establish a relationship between LTRS and increased citations and raises at least as many questions as it answers, we hope it will serve as a invitation to, and guide for, further research in the use of DLs.
Author
Libraries; Information Retrieval; Information Dissemination; On-Line Systems

20040087004 NASA Langley Research Center, Hampton, VA, USA
Predicting Mission Success in Small Satellite Missions
Saunders, Mark; Richie, Wayne; Rogers, John; Moore, Arlene; [1992]; 11 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

In our global society with its increasing international competition and tighter financial resources, governments, commercial entities and other organizations are becoming critically aware of the need to ensure that space missions can be achieved on time and within budget. This has become particularly true for the National Aeronautics and Space Administration's (NASA) Office of Space Science (OSS) which has developed their Discovery and Explorer programs to meet this need. As technologies advance, space missions are becoming smaller and more capable than their predecessors. The ability to predict the mission success of these small satellite missions is critical to the continued achievement of NASA science mission objectives. The NASA Office of Space Science, in cooperation with the NASA Langley Research Center, has implemented a process to predict the likely success of missions proposed to its Discovery and Explorer Programs. This process is becoming the basis for predicting mission success in many other NASA programs as well. This paper describes the process, methodology, tools and synthesis techniques used to predict mission success for this class of mission.
Author
NASA Programs; Organizations; Space Missions

20040087127 NASA Kennedy Space Center, Cocoa Beach, FL, USA
Hot Shot
Covault, Craig; Aviation Week and Space Technology; July 26, 2004; Volume 161, No. 4, pp. 58-59; In English; Copyright; Avail: Other Sources

The NASA Messenger spacecraft is ready for launch to Mercury on a mission researchers hope will unravel why the closest planet to the Sun is so dramatically different from its siblings-Earth, Venus and Mars-all born from the same solar nebula 5 billion years ago. The NASA/Johns Hopkins Applied Physics Laboratory (APL) spacecraft is to lift off here Aug. 2 at 216 a.m. EDT on a Boeing Delta I1 Heavy booster. Development of the $426- million mission has involved 800 people from 50 contractors and organizations spread across 24 U.S. states and six countries. Canadian, Italian and German companies are among the major contractors.
Derived from text
Launching; Mercury (Planet); Space Missions

20040095296 Defence Science and Technology Organisation, Edinburgh, Australia

Historical Analysis of Population Reactions to Stimuli: A Case Study of Aceh

Dexter, Patricia; July 2004; 46 pp.; In English

Report No.(s): DSTO-TR-1592; DODA-AR-013-128; Copyright; Avail: Other Sources

This study provides a baseline investigation for determining population reactions to stimuli in a historical context. Historical data analysis and qualitative data analysis techniques are applied to the last 500 years of events in Aceh. Links and trends between events and stimuli as causes and triggers are produced giving a preliminary dataset for any future trends impact analysis. In addition some general population reactions for Aceh are established.

Author

Histories; Qualitative Analysis; Data Processing

83
ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

20040086899 Boeing Co., Canoga Park, CA, USA

The Product Development Imperative: Business Case for the Robust Design Computational System (RDCS) and the Acceleration Insertion of Materials (AIM) Technologies

Havskjold, Glenn; Innovative Design of Complex Engineering Systems; July 2004, pp. 31-57; In English; See also 20040086893; No Copyright; Avail: CASI; A03, Hardcopy

To develop an advanced technology aerospace product on budget and on schedule, data indicates that what I am labeling a Product Development Imperative exists. This presentation discusses that imperative and shows how critical capabilities have been developed in the Robust Design Computational System and are being developed in the Accelerated Insertion of Materials program.A chart from a NASA study, published in Aerospace America, illustrates the economic issues in deciding to invest in an access to space capability. For each option shown, an up-front investment is required to achieve a desired benefit. Generally, the greater the desired benefit, the more investment is required. In the private sector, a financial analyst would compute a return on investment or an internal rate of return to assess the worth of the investment. Government agencies may or may not use such an analysis, but to justify investing, at some point a decision is made that the benefit of some option is worth the investment. If the size of the required cost increases, if the schedule increases, or if the benefit is smaller than planned, the cost-benefit analysis associated with the investment may be compromised. For development programs, the issue is how to develop an advanced technology product on a planned budget, on a planned schedule, and achieve the targeted goals.

Author

Cost Effectiveness; NASA Programs; Cost Analysis

88
SPACE SCIENCES (GENERAL)

Includes general research topics related to the natural space sciences. For specific topics in space sciences see *categories 89 through 93*.

20040086726 NASA Glenn Research Center, Cleveland, OH, USA

Radiation in Space and Its Control of Equilibrium Temperatures in the Solar System

Juhasz, Albert J.; July 2004; 14 pp.; In English; 34th International Conference on Environmental Systems, 19-22 Jul. 2004, Colorado Springs, CO, USA

Contract(s)/Grant(s): WBS 22-319-30-C2

Report No.(s): NASA/TM-2004-213191; E-14690; Rept-2004-01-2518; No Copyright; Avail: CASI; A03, Hardcopy

The problem of determining equilibrium temperatures for reradiating surfaces in space vacuum was analyzed and the resulting mathematical relationships were incorporated in a code to determine space sink temperatures in the solar system. A brief treatment of planetary atmospheres is also included. Temperature values obtained with the code are in good agreement with available spacecraft telemetry and meteorological measurements for Venus and Earth. The code has been used in the design of space power system radiators for future interplanetary missions.

Author

Solar System; Space Temperature; Extraterrestrial Radiation; Thermodynamic Equilibrium

20040086904 NASA Ames Research Center, Moffett Field, CA, USA
Planning and Execution: The Spirit of Opportunity for Robust Autonomous Systems
Muscettola, Nicola; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

One of the most exciting endeavors pursued by human kind is the search for life in the Solar System and the Universe at large. NASA is leading this effort by designing, deploying and operating robotic systems that will reach planets, planet moons, asteroids and comets searching for water, organic building blocks and signs of past or present microbial life. None of these missions will be achievable without substantial advances in.the design, implementation and validation of autonomous control agents. These agents must be capable of robustly controlling a robotic explorer in a hostile environment with very limited or no communication with Earth. The talk focuses on work pursued at the NASA Ames Research center ranging from basic research on algorithm to deployed mission support systems. We will start by discussing how planning and scheduling technology derived from the Remote Agent experiment is being used daily in the operations of the Spirit and Opportunity rovers. Planning and scheduling is also used as the fundamental paradigm at the core of our research in real-time autonomous agents. In particular, we will describe our efforts in the Intelligent Distributed Execution Architecture (IDEA), a multi-agent real-time architecture that exploits artificial intelligence planning as the core reasoning engine of an autonomous agent. We will also describe how the issue of plan robustness at execution can be addressed by novel constraint propagation algorithms capable of giving the tightest exact bounds on resource consumption or all possible executions of a flexible plan.
Author

Mars Roving Vehicles; Autonomy; Solar System; Artificial Intelligence; Planning; Scheduling

89
ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20040086561 Hawaii Univ., HI, USA
Search for Near-Earth Objects with Small Aphelion Distances
Tholen, David J.; [2004]; 15 pp.; In English
Contract(s)/Grant(s): NAG5-12406; No Copyright; Avail: CASI; A03, Hardcopy

Progress for the period 13 July 2003 through 11 August 2004 is reported. Report topics include personnel, NEO follow-up astrometry, and the continued search for near-Earth asteroids with small aphelion distances.
CASI

Aphelions; Asteroids; Astrometry; Near Earth Objects

20040086626 Johns Hopkins Univ., USA
FUV and Optical Spectroscopy of Hot Post-AGB Stars in Globular Clusters
Dixon, William V.; [2004]; 1 pp.; In English
Contract(s)/Grant(s): NAG5-10916; No Copyright; Avail: CASI; A01, Hardcopy

The goal of this program was to determine the atmospheric parameters (effective temperature and surface gravity) and abundances of the hot, post-AGB (PAGB) stars in globular clusters observed with the Hopkins Ultraviolet Telescope (HUT) on the Astro-l and 2 missions.
Author

Globular Clusters; Hot Stars; Spaceborne Telescopes; Ultraviolet Telescopes

20040086729 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
RR Tel: Getting Under the Flux Limit: An Observation with FUSE
Sonnenborn, George, Technical Monitor; Kenyon, Scott J.; August 2004; 2 pp.; In English
Contract(s)/Grant(s): NAG5-12420; No Copyright; Avail: CASI; A01, Hardcopy

The goal of this program is to acquire a FUSE spectrum of the symbiotic binary RR Tel. With these data, we plan to derive improved constraints on the hot component, the nebula, and perhaps the red giant wind. Based on results from AG Dra, we should also be able to use some line detections to improve atomic parameters for high ionization emission lines. This results would benefit the general FUSE community. As of this writing, the FUSE observation of RR Tel has not been made. Because

RR Tel is a very bright UV source, the FUSE team is assessing the likelihood that RR Tel will have an adverse affect on the instrument.
Author (revised)
Far UV Spectroscopic Explorer; Ultraviolet Astronomy; Symbiotic Stars

20040086789 Hawaii Univ., Honolulu, HI, USA
Detecting the Sun in 2-Gyr Old Open Clusters
Simon, Theodore; January 2004; 2 pp.; In English
Contract(s)/Grant(s): NAG5-13139; No Copyright; Avail: CASI; A01, Hardcopy

The aim of this observation was to take advantage of the large collecting area and sensitivity of the European Space Agency's XMM-Newton telescope to survey the X ray brightness of solar-mass stars in the 2 Gyr old NGC 752 cluster in order to chart out the dependence of coronal X ray emission of Sun like stars as a function of age. Dr. Simon's stated role as one of the co-investigators in the project was limited to assisting the project's European Principal Investigator with the analysis and interpretation of the X ray measurements, and to assist in summarizing the results for publication. The observation was executed successfully, and approximately 130 X ray sources were detected in the XMM field of view and subsequently measured to obtain X ray count rates. To date neither the measurements nor the raw data have been distributed by the European P.I. to the co-investigators, It is expected that the measurements will be distributed to the co-investigators by the end of 2004, and once that is done, the scientific analysis by Dr. Simon can then begin. At present, since the data and measurements have not been shared with the co-investigators, there are no results to report.
Author
X Ray Astronomy; Stellar Luminosity; Open Clusters

20040086879 NASA Ames Research Center, Moffett Field, CA, USA
Mid and Near-IR Absorption Spectra of PAH Neutrals and Ions in H20 Ice to Facilitate their Astronomical Detection
Bernstein, Max P.; Sandford, Scott A.; Allamandola, Louis J.; [2004]; 1 pp.; In English; 35th COSPAR Meeting, Jul. 2004, Paris, France
Contract(s)/Grant(s): 344-58-12-04; No Copyright; Avail: Other Sources; Abstract Only

Polycyclic aromatic hydrocarbons (PAHs) are believed to be the most abundant and widespread class of organic compounds in the universe, having been observed in emission towards energetic regions and absorption towards colder ones.We will present IR spectra of PAHs and their cations in H20 ice measured in the laboratory in the hopes that this will facilitate the detection of these features in the interstellar medium.
Author
Polycyclic Aromatic Hydrocarbons; Near Infrared Radiation; Cations; Absorption Spectra; Organic Compounds

20040086892 NASA Ames Research Center, Moffett Field, CA, USA
The L to T Dwarf Transition
Marley, Mark; [2004]; 1 pp.; In English; Cool Stars, Stellar Systems and The Sun 13, 5-9 Jul. 2004, Hamburg, Germany
Contract(s)/Grant(s): 187-02-00-06; No Copyright; Avail: Other Sources; Abstract Only

At least three explanations have been proposed to explain the rapidity of the L to T dwarf transition. These ideas have included a continuously sinking, thin cloud layer, horizontally patchy cloudiness, and a rapid increase in the cloud sedimentation efficiency at a given effective temperature. With the advent of measured parallaxes for a large number of late L through early T dwarfs we now know that the transition takes place at roughly constant effective temperature, which places severe constraints on all of the proposed mechanisms. In addition high quality spectral datasets from Spitzer Space Telescope/IRS and IRTF/SpeX, now provide a wealth of new information about objects at the L to T transition and substantially increase the wavelength range over which the effects of clouds can be modeled. After comparing our model spectra with these datasets I will discuss how well the various mechanisms can account for the observed spectra of L and T dwarfs and other observables. In addition I will consider how gravity signatures among the L/T transition objects can further constrain the transition mechanism. I will argue that the preponderance of evidence favors models in which the cloud behavior undergoes fundamental changes at the transition. Mass or gravity selection effects do not adequately account for all of the available data.
Author
Dwarf Stars; Cloud Physics; Cloud Cover; Parallax; Signatures

20040086905 NASA Ames Research Center, Moffett Field, CA, USA
On-Orbit Performance of the Spitzer Space Telescope
Roellig, Thomas; Werner, Michael; Gallagher, David; Irace, William; Fazio, Giovanni; Houck, James; Rieke, George; Wilson, Robert; Soifer, Thomas; March 15, 2004; 1 pp.; In English; SPIE Conference on Astronomical Telescopes and Instrumentation 2004, 21-25 Jun. 2004, Glasgow, Scotland, UK
Contract(s)/Grant(s): WBS 21-456-06-1R; No Copyright; Avail: CASI; A01, Hardcopy

The Spitzer Space Telescope (formally known as SIRTF) was successfully launched on August 25, 2003, and has completed its initial in-orbit checkout and science validation and calibration period. The measured performance of the observatory has met or exceeded all of its high-level requirements, it has entered normal operations, and is beginning to return high-quality science data. A superfluid-helium cooled 85 cm diameter telescope provides extremely low infrared backgrounds and feeds three science instruments covering wavelengths ranging from 3.2 to 180 microns. The telescope optical quality is excellent, providing diffraction-limited performance down to wavelengths below 6.5 microns. Based on the first helium mass and boil-off rate measurements, a cryogenic lifetime in excess of 5 years is expected. This presentation will provide a summary of the overall performance of the observatory, with an emphasis on those performance parameters that have the greatest impact on its ultimate science return.
Author
Space Infrared Telescope Facility; Astronomical Observatories; NASA Space Programs

20040087039 NASA Ames Research Center, Moffett Field, CA, USA
Photoevaporating Disks Around Young Stars
Hollenbach, David; [2004]; 1 pp.; In English; Cores, Disks, Jets and Outlaws, 11-16 Jul. 2004, Baniff, Canada
Contract(s)/Grant(s): RTOP 21-456-06; No Copyright; Avail: Other Sources; Abstract Only

Ultraviolet radiation from the central star or from a nearby massive star heats the surfaces of protoplanetary disks and causes the outer, less gravitationally bound part of the disks, to photoevaporate into interstellar space. Photoevaporation is likely the most important dispersal mechanism for the outer regions of disks. We focus in this talk on disks around low-mass stars like the Sun rather than high-mass stars, which we have treated previously. Stars often form in clusters and the ultraviolet flux from the most luminous star in the cluster can have a dramatic effect on the disk orbiting a nearby low-mass star. We apply our theoretical models to the evaporating protoplanetary disks (or 'proplyds") in the Trapezium cluster in Orion, to the formation of gas giant planets like Jupiter around Sun-like stars in the Galaxy, and to the formation of Kuiper belts around low mass stars. We discuss recent models of the effects of the radiation from the central low mass star including both the predicted infrared spectra from the heated disks as well as preliminary results on the photoevaporation rates.
Author
Protoplanetary Disks; Interstellar Space; Massive Stars; Mathematical Models

20040087149 Colorado Univ., Boulder, CO, USA
X-Ray Reprocessing in Active Galactic Nuclei
Begelman, Mitchell C.; August 13, 2004; 3 pp.; In English
Contract(s)/Grant(s): NAG5-6337; No Copyright; Avail: CASI; A01, Hardcopy

This is the final report for research entitled 'X-ray reprocessing in active galactic nuclei,' into X-ray absorption and emission in various classes of active galaxy via X-ray spectral signatures. The fundamental goal of the research was to use these signatures as probes of the central engine structure and circumnuclear environment of active galactic nuclei. The most important accomplishment supported by this grant involved the detailed analysis and interpretation of the XMM data for the bright Seyfert 1 galaxy MCG-6-30-15. This work was performed by Drs. Christopher Reynolds and Mitchell Begelman in collaboration with Dr. Jorn Wilms (University of Tubingen, Germany; PI of the XMM observation) and other European scientists. With XMM we obtained medium resolution X-ray spectra of unprecedented quality for this Seyfert galaxy. Modeling the X-ray spectrum within the framework of accretion disk reflection models produced the first evidence for energy extraction from the spin of a black hole. Specifically, we found that the extreme gravitational redshifts required to explain the X-ray spectrum suggests that the bulk of the energy dissipation is concentrated very close to the black hole, in contrast with the expectations of any pure accretion disk model. In a second paper we addressed the low- energy spectral complexity and used RXTE specta to pin down the high-energy spectral index, thus firming up our initial interpretation. Additionally, we carried out detailed spectral and variability analyses of a number of Seyfert and radio galaxies (e.g., NGC 5548 and 3C 111) and developed general techniques that will be useful in performing X-ray reverberation mapping of accretion disks in AGN,

once adequate data becomes available. A list of papers supported by this research is included.
Derived from text
Active Galactic Nuclei; X Ray Spectra; X Ray Astronomy; Spectral Signatures

20040090633 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Swift Gamma Ray Burst Mission
Gehrels, Neil; [2004]; 1 pp.; In English; COSPAR 2004, 18-25 Jul. 2004, Paris, France; No Copyright; Avail: Other Sources; Abstract Only

Swift is an international mission managed by NASA as part of its MIDEX program. It is a multiwavelength transient observatory for GRB astronomy that will launch in 2004. The goals of the mission are to determine the origin of GRBs and their afterglows and use bursts to probe the early Universe. A wide field gamma-ray camera will detect more than a hundred GRBs per year to 2-5 times fainter than BATSE. Sensitive narrow-field X-ray, and UV/optical telescopes will be pointed at the burst location in 20 to 75 sec by an autonomously controlled 'swift' spacecraft. For each burst, arcsec positions will be determined and optical/UV/x-ray/gamma-ray spectrophotometry performed. Measurements of redshift will be made for many of the bursts. The instrumentation is a combination of superb existing flight-spare hardware and design from XMM and Spectrum-X/JET-X contributed by collaborators in the UK and Italy and development of a coded-aperture camera with a large-area (approx. 0.5 square meter) CdZnTe detector array. The instruments have now completed their fabrication phase and are integrated on the observatory for final testing. Key components of the mission are vigorous follow-up and outreach programs to engage the astronomical community and public in Swift. The talk will describe the mission and its status and give a summary of our plans for GRB operations.
Author
Gamma Ray Bursts; Astronomical Satellites

20040095324 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Resolving the Large Scale Spectral Variability of the Luminous Seyfert 1 Galaxy 1H 0419-577
Pounds, K. A.; Reeves, J. N.; Page, K. L.; OBrien, P. T.; [2004]; 34 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

An XMM-Newton observation of the luminous Seyfert 1 galaxy 1H 0419-577 in September 2002, when the source was in an extreme low-flux state, found a very hard X-ray spectrum at 1-10 keV with a strong soft excess below approximately 1 keV. Comparison with an earlier XMM-Newton observation when 1H 0419-577 was X-ray bright indicated the dominant spectral variability was due to a steep power law or cool Comptonized thermal emission. Four further XMM-Newton observations, with 1H 0419-577 in intermediate flux states, now support that conclusion, while we also find the variable emission component in intermediate state difference spectra to be strongly modified by absorption in low ionisation matter. The variable soft excess is seen to be an artefact of absorption of the underlying continuum while the core soft emission is attributed to recombination in an extended region of more highly ionised gas. This new analysis underlines the importance of fully accounting for absorption in characterizing AGN X-ray spectra.
Author
Seyfert Galaxies; Variability; X Ray Astronomy; Stellar Luminosity; X Ray Spectra

90
ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20040086551 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Removing Activity-Related Radial Velocity Noise to Improve Extrasolar Planet Searches
Saar, Steven; Lindstrom, David M., Technical Monitor; August 2004; 5 pp.; In English
Contract(s)/Grant(s): NAG5-10630; No Copyright; Avail: CASI; A01, Hardcopy

We have made significant progress towards the proposal goals of understanding the causes and effects of magnetic activity-induced radial velocity (v_r) jitter and developing methods for correcting it. In the process, we have also made some significant discoveries in the fields of planet-induced stellar activity, planet detection methods, M dwarf convection, starspot properties, and magnetic dynamo cycles. We have obtained super high resolution (R approximately 200,000), high S / N (greater than 300) echelle study of joint line bisector and radial velocity variations using the McDonald 2-D coude. A long observing run in October 2002 in particular was quite successful (8 clear nights). We now have close to three years of data,

which begins to sample a good fraction of the magnetic cycle timescales for some of our targets (e.g., kappa Ceti; P_cyc = 5.6 yrs). This will be very helpful in unraveling the complex relationships between plage and radial velocity (v-r) changes which we have uncovered. Preliminary analysis (Saar et al. 2003) of the data in hand, reveals correlations between median line bisector displacement and v_r. The correlation appears to be specific the the particular star being considered, probably since it is a function of both spectral type and rotation rate. Further analysis and interpretation will be in the context of evolving plage models and is in progress.
Derived from text
Extrasolar Planets; Radial Velocity; Acoustics; Vibration

20040086627 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Hybrid Stars and Coronal Evolution
Mushotzky, Richard, Technical Monitor; Dupree, Andrea K.; August 2004; 3 pp.; In English
Contract(s)/Grant(s): NAG5-9977
Report No.(s): SAO-16613321; No Copyright; Avail: CASI; A01, Hardcopy

This program addresses the evolution of stellar coronas by comparing a solar-like corona in the supergiant Dra (G2 Ib-IIa) to the corona in the allegedly more evolved state of a hybrid star, TrA (K2 11-111). Because the hybrid star has a massive wind, it appears likely that the corona will be cooler and less dense as the magnetic loop structures are no longer closed. By analogy with solar coronal holes, when the topology of the magnetic field is configured with open magnetic structures, both the coronal temperature and density are lower than in atmospheres dominated by closed loops. The hybrid stars assume a pivotal role in the definition of coronal evolution, atmospheric heating processes and mechanisms to drive winds of cool stars.
Author
Stellar Coronas; Supergiant Stars; Stellar Evolution

20040086801 Space Telescope Science Inst., Baltimore, MD, USA
FUSE Observations of the Bright, Eclipsing Nova-like Cataclysmic Variable, UX UMa (FUSE 2000)
Long, Knox; Froning, Cynthia; August 17, 2004; 3 pp.; In English
Contract(s)/Grant(s): NAG5-10381; No Copyright; Avail: CASI; A01, Hardcopy

This was a project to study the disk and wind of the eclipsing nova-like variable UX UMa, in order to better define the wind geometry of the system, including the nature of the transition region between the disk photosphere and the supersonic wind. We proposed to use phase resolved spectroscopy of the system, taking advantage of the fact that UX UMa is an eclipsing system, to isolate different regions of the wind and to use a Monte Carlo radiative transfer code to simulate the spectra through the eclipse.
Author
Spectroscopy; Far UV Spectroscopic Explorer; Radiative Transfer; Eclipsing Binary Stars; Cataclysmic Variables

20040087095 NASA Ames Research Center, Moffett Field, CA, USA
Formation and Destruction Processes of Interstellar Dust: From Organic Molecules to carbonaceous Grains
Salama, F.; Biennier, L.; [2004]; 1 pp.; In English; COSPAR Conference, 18-25 Jul. 2004, Paris, France; No Copyright; Avail: Other Sources; Abstract Only

The study of the formation and destruction processes of cosmic dust is essential to understand and to quantify the budget of extraterrestrial organic molecules. interstellar dust presents a continuous size distribution from large molecules, radicals and ions to nanometer-sized particles to micron-sized grains. The lower end of the dust size distribution is thought to be responsible for the ubiquitous spectral features that are seen in emission in the IR (UIBs) and in absorption in the visible (DIBs). The higher end of the dust-size distribution is thought to be responsible for the continuum emission plateau that is seen in the IR and for the strong absorption seen in the interstellar UV extinction curve. All these spectral signatures are characteristic of cosmic organic materials that are ubiquitous and present in various forms from gas-phase molecules to solid-state grains. Although dust with all its components plays an important role in the evolution of interstellar chemistry and in the formation of organic molecules, little is known on the formation and destruction processes of dust. Recent space observations in the UV (HST) and in the IR (ISO) help place size constraints on the molecular component of carbonaceous IS dust and indicate that small (ie., subnanometer) PAHs cannot contribute significantly to the IS features in the UV and in the IR. Studies of large molecular and nano-sized IS dust analogs formed from PAH precursors have been performed in our laboratory under conditions that simulate diffuse ISM environments (the particles are cold -100 K vibrational energy, isolated in the gas phase and exposed to a high-energy discharge environment in a cold plasma). The species (molecules, molecular

fragments, ions, nanoparticles, etc) formed in the pulsed discharge nozzle (PDN) plasma source are detected with a high-sensitivity cavity ring-down spectrometer (CRDS). We will present new experimental results that indicate that nanoparticles are generated in the plasma. From these unique measurements, we derive information on the nature, the size and the structure of interstellar dust particles, the growth and the destruction processes of IS dust and the resulting budget of extraterrestrial organic molecules.
Author
Interstellar Matter; Organic Materials; Carbonaceous Materials; Granular Materials; Destruction; Cosmic Dust

20040090615 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Decelerating Flows in the TeV Blazars
Kazanas, Demosthenes; [2004]; 1 pp.; In English; International Symposium on High Energy Gamma-Ray Astronomy, 26-30 Jul. 2004, Heidelberg, Germany; No Copyright; Avail: Other Sources; Abstract Only

TeV emission from a class of BL Lacertae (BL) objects is commonly modeled as radiation from relativistically moving homogeneous plasma blobs. In the context of these models, the blob Lorentz factors needed to reproduce the (corrected for absorption by the IR background) TeV emission are large ($\delta \gtrsim 50$) are required to reproduce via Synchrotron-Self Compton (SSC) the observed TeV emission. The main reason for this is that stronger beaming eases the problem of the lack of $\sim$ IR-UV synchrotron seed photons needed to produce the de-absorbed $\sim$ few TeV peak of the spectral energy distribution (SED). However, such high Doppler factors are in strong disagreement with the unified scheme, according to which BLs are FR I radio galaxies with their jets closely aligned to the line of sight. Here, motivated by the detection of sub-luminal velocities in the sub-pc scale jets of the best studied TeV blazars, MKN 421 and MKN 501. we examine the possibility that the relativistic flow in the TeV BLs is longitudinally decelerating. In this case, the problem of the missing seed photons is solved due to Upstream Compton (UC) scattering, a process in which the upstream energetic electrons from the fast base of the flow 'see' the synchrotron seed photons produced in the slow part of the flow relativistically beamed. Modest Lorentz factors ($\Gamma kim 15s). decelerating down to values compatible with the recent radio interferometric observations, reproduce the $\sim$ few TeV peak energy of these sources. Furthermore, such decelerating flows are shown to be in agreement with the BL - FR I unification.
Author
Bl Lacertae Objects; Magnetohydrodynamic Flow; Relativistic Plasmas

20040095306 NASA Goddard Space Flight Center, Greenbelt, MD, USA
CHANDRA Detection of the AM CVn Binary ES Cet (KUV 01584-0939)
Strohmayer, Tod E.; [2004]; 13 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

We report on Chandra ACE observations of the ultracompact AM CVn binary ES Cet. This object has a 10.3 minute binary period and is the most compact of the confirmed AM CVn systems. We have, for the first time, unambiguously detected the X-ray counterpart to ES Cet. In a 20 ksec ACIS-S image a point-like X-ray source is found within 1 sec. of the catalogued optical position. The mean countrate in ACIS-S is 0.013/s, and there is no strong evidence for variability. We folded the X-ray data using the optical ephemeris of Warner & Woudt, but did not detect any significant modulation. If an approx. = 100% modulation similar to those seen in the ultracompact candidates V407 Vu1 and Rx J0806.3+1527 were present then we would have detected it. The upper limit (3(sigma)) to any modulation at the putative orbital period is approx. 40% (rms). We extract the first X-ray spectrum from ES Cet, and find that it is not well described by simple continuum models. We find suggestive evidence for discrete spectral components at approx. 470 and 890 eV, that can be modelled as gaussian emission lines. In comparison with recent X-ray detections of nitrogen and neon in another AM CVn system (GP Com), it appears possible that these features may represent emission lines from these same elements; however, deeper spectroscopy will be required to confirm this. Our best spectral model includes a black body continuum with kT = 0.8 keV along with the gaussian lines. The 0.2 - 5 keV X-ray flux was approx. 7 x 10(exp -14) ergs/sq cm s. The luminosity implied by this flux for any reasonable distance is much smaller than that expected for a mass accretion rate as high as m = 10(exp -8) solar mass/yr, suggesting that the bulk of the accretion luminosity is below 100 eV and not seen with Chandra. We discuss the implications of our results for the nature of ES Cet.
Author
Emission Spectra; Stellar Mass; Spectral Theory; Continuum Modeling

20040095336 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Power Spectrum of Atmospheric Scintillation for the Deep Space Network Goldstone Ka-Band Downlink
Ho, C.; Wheelon, A.; Interplanetary Network Progress Report; August 15, 2004; Volume 42-158; 21 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Dynamic signal fluctuations due to atmospheric scintillations may impair the Ka-band (around 32-GHz) link sensitivities for a low-margin Deep Space Network (DSN) receiving system. The ranges of frequency and power of the fast fluctuating signals (time scale less than 1 min) are theoretically investigated using the spatial covariance and turbulence theory. Scintillation power spectrum solutions are derived for both a point receiver and a finite-aperture receiver. The aperture-smoothing frequency ((omega(sub s)), corner frequency ((omega(sub c)), and damping rate are introduced to define the shape of the spectrum for a finite-aperture antenna. The emphasis is put on quantitatively describing the aperture-smoothing effects and graphically estimating the corner frequency for a large aperture receiver. Power spectral shapes are analyzed parametrically in detail through both low- and high-frequency approximations. It is found that aperture-averaging effects become significant when the transverse correlation length of the scintillation is smaller than the antenna radius. The upper frequency or corner frequency for a finite-aperture receiver is controlled by both the Fresnel frequency and aperture-smoothing frequency. Above the aperture-smoothing frequency, the spectrum rolls off at a much faster rate of exp (-omega(sup 2)/omega(sup 2, sub s), rather than omega(sup -8/3), which is customary for a point receiver. However, a relatively higher receiver noise level can mask the fast falling-off shape and make it hard to be identified. We also predict that when the effective antenna radius a(sub r) less than or = 6 m, the corner frequency of its power spectrum becomes the same as that for a point receiver. The aperture-smoothing effects are not obvious. We have applied these solutions to the scenario of a DSN Goldstone 34-m-diameter antenna and predicted the power spectrum shape for the receiving station. The maximum corner frequency for the receiver (with omega(sub s) = 0.79 omega(sub 0) is found to be 0.44 Hz (or 1.0 omega(sub 0), while the fading rate (or fading slope) is about 0.06 dB/s.
Author
Power; Spectra; Atmospheric Scattering; Scintillation; Deep Space Network; Downlinking; Extremely High Frequencies

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LUNAR AND PLANETARY SCIENCE AND EXPLORATION

Includes planetology; selenology; meteorites; comets; and manned and unmanned planetary and lunar flights. For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance*.

20040086644 NASA Langley Research Center, Hampton, VA, USA
Evaluation of Mars Entry Reconstructured Trajectories Based on Hypothetical 'Quick-Look' Entry Navigation Data
Pastor, P. Rick; Bishop, Robert H.; Striepe, Scott A.; [2000]; 18 pp.; In English
Contract(s)/Grant(s): NAS9-97045; No Copyright; Avail: CASI; A03, Hardcopy

A first order simulation analysis of the navigation accuracy expected from various Navigation Quick-Look data sets is performed. Here quick-look navigation data are observations obtained by hypothetical telemetried data transmitted on the fly during a Mars probe's atmospheric entry. In this simulation study, navigation data consists of 3-axis accelerometer sensor and attitude information data. Three entry vehicle guidance types are studied: I. a Maneuvering entry vehicle (as with Mars 01 guidance where angle of attack and bank angle are controlled); II. Zero angle-of-attack controlled entry vehicle (as with Mars 98); and III. Ballistic, or spin stabilized entry vehicle (as with Mars Pathfinder);. For each type, sensitivity to progressively under sampled navigation data and inclusion of sensor errors are characterized. Attempts to mitigate the reconstructed trajectory errors, including smoothing, interpolation and changing integrator characteristics are also studied.
Author
Atmospheric Entry; Navigation; Trajectories; Mars Probes; Computerized Simulation

20040086713 Dornheim (Michael A.), Pasadena, CA, USA
Fresher Water: Presence of Water Is Advanced to More Recent Times, and Spirit Rolls Over its First Bedrock
Dornheim, Michael A.; Aviation Week and Space Technology; July 26, 2004; ISSN 0005-2175; Volume 161, No. 4, pp. 41; In English; Copyright; Avail: Other Sources

New evidence points to an era of water on the Meridiani Planum region of Mars more recent than already found, based on continuing scouting by NASA's 'Opportunity' Mars Exploration Rover inside the Endurance crater. Scientists had already concluded that the ubiquitous bedrock around Opportunity was formed and modified by water. But the latest finding shows that water was probably also present after a meteor whacked the existing bedrock, creating the 130 meter diameter (430 foot) crater. Scientists are not able to put an absolute date on any of the events, but they are confident that the new evidence advances the period of surface water on the planet, compared with prior Opportunity observations.
Author
Planetary Geology; Water; Mars Roving Vehicles; Mars Surface

20040086714 NASA Glenn Research Center, Cleveland, OH, USA

The Use of Nuclear Propulsion, Power and 'In-Situ' Resources for Routine Lunar Space Transportation and Commercial Base Development

Borowski, Stanley K.; [2003]; 15 pp.; In English; International Lunar Conference 2003, 16-22 Nov. 2003, Waikoloa, HI, USA
Contract(s)/Grant(s): 22-319-30-C2; No Copyright; Avail: CASI; A03, Hardcopy

This viewgraph presentation illustrates possible future strategies for solar system exploration supported by Nuclear Thermal Rocket (NTR) Propulsion. Topics addressed in the presentation include: lunar mining, Liquid Oxygen (LOX) augmented NTR (LANTR), 'Shuttle-Derived' Heavy Lift Vehicle (SDHLV) options for future human Lunar missions, and lunar-produced oxygen (LUNOX).
CASI

Nuclear Propulsion; Space Transportation; Lunar Mining; In Situ Resource Utilization; Space Industrialization

20040086783 NASA Ames Research Center, Moffett Field, CA, USA

Solar System Studies in the Infrared with the Spitzer Space Telescope

Cruikshank, D. P.; Stansberry, J. A.; Cleve, J. Van; Burgdorf, M. J.; Fernandez, Y. R.; Meadows, V. S.; Reach, W. T.; May 05, 2004; 1 pp.; In English; Committee on Space Research Meeting, 18-25 Jul. 2003, Paris, France
Contract(s)/Grant(s): 456-06-1C; No Copyright; Avail: Other Sources; Abstract Only

The Spitzer Space Telescope, formerly known as SIRTF, is a cryogenic telescope (85 cm diameter) operating in a heliocentric orbit trailing the Earth. Its three instruments provide capabilities for spectroscopy, wide-field and small-field imaging at many wavelengths in the range 3.5-160 microns. Observations to be executed in the first two years in programs defined by the Guaranteed Time Observer (GTO) group (the authors of this presentation) consist of photometry, spectroscopy, and radiometry of many Solar System objects, including Titan and other satellites of the outer planets, Pluto, Centaurs, trans-Neptunian objects, comers, asteroids, Uranus, and Neptune. At the time of the preparation of this abstract, some preliminary observations have been made, but the final calibration and reduction of the data are still in progress. The latest results of the Solar System investigations will be presented here.
Author

Solar System; Infrared Astronomy; Space Infrared Telescope Facility

20040086784 NASA Ames Research Center, Moffett Field, CA, USA

Tholins as Coloring Agents on Solar System Bodies

Cruikshank, D. P.; Ore, C. M. Dalle; Imanaka, H.; May 05, 2004; 1 pp.; In English; Committee on Space Research, 18-25 Jul. 2004, Paris, France
Contract(s)/Grant(s): 456-06-1C; No Copyright; Avail: Other Sources; Abstract Only

Pre-biotic organic materials appear to be common on many small bodies in the outer Solar System, as evidenced by the color properties of these objects. We report on our continuing study of color properties in connection with the presence of complex organic solids (tholins) among the planets and their satellites, the asteroids, and the trans- Neptunian objects (Kuiper Belt objects). Most small, icy bodies in the Solar System, whether they have high or low surface reflectance (albedo), show a pronounced downward slope in reflectance at wavelengths shorter than approx. 1 micron. This increasing absorption of sunlight toward shorter wavelengths is characteristic of pi-bonds in hydrocarbons having chains or rings of conjugated C atoms. Tholins, which contain polycyclic aromatic and aliphatic hydrocarbons, exhibit these color properties. Using the complex refractive indices of tholins in models of the reflectance spectra of icy bodies in the Solar System, we find that these complex organic materials satisfactorily account for the coloration so widely observed. The new results presented here show that the wide variety of colors of Kuiper Belt objects can be fit very well with tholins, as can the colors of Pluto and Triton. The implications of these fits of Kuiper Belt objects is that complex organic material is created on their surfaces by energetic particle bombardment of native ices, and also may be accreted from external sources. In the cases of Pluto and Triton, photochemistry of their weak N2 + CH4 + CO atmospheres produces complex organic molecules that precipitate to the surface, providing local color.
Author

Organic Solids; Color; Kuiper Belt; Icy Satellites

20040086799 California Univ., Los Angeles, CA, USA

Development of Global Magnetosphere Models of Jupiter

Khurana, Krishan K.; [2004]; 5 pp.; In English
Contract(s)/Grant(s): NAG5-9546; No Copyright; Avail: CASI; A01, Hardcopy

The objective of the proposal was to construct global magnetospheric models of Jupiter for the use of Jovian magnetospheric community. In the four years of the grant period we were able to achieve all of the stated science objectives. The work has resulted in: 1) A new structural model of Jovian current sheet; 2) Global thickness map of the current sheet; 3) Magnetic field models of the current sheet; 4) The global model of Jupiter's magnetospheric field including hinging and delay of the current sheet, sweepback of the magnetic field and the shielding field of the magnetopause. To accomplish our work, we assembled an exhaustive magnetic field data base from all of the spacecraft that have visited Jupiter (Pioneers 10 and 11, Voyagers 1 and 2, Ulysses and Galileo). The data were rotated into system III and JSM coordinates. We used the data at resolutions of 1 minute (for studies of the structure of the current sheet) and 10 minutes (for building the global model).
Author (revised)
Jupiter Atmosphere; Planetary Magnetospheres; Atmospheric Models

20040086800 California Univ., Los Angeles, CA, USA
Asymmetries and Variations in Jupiter's Magnetosphere
Khurana, Krishan K.; [2003]; 3 pp.; In English
Contract(s)/Grant(s): NAG5-8945; No Copyright; Avail: CASI; A01, Hardcopy

The investigation was carried out to infer the influence of solar wind on Jupiter's magnetosphere through studies of asymmetries and variations in the magnetosphere. We used the magnetic field observations from all of the pre-Galileo spacecraft and from the Galileo Prime and extended missions to understand asymmetries in magnetic field and various current systems in the magnetosphere.
Author
Asymmetry; Jupiter (Planet); Magnetic Fields; Galileo Project

20040086918 Science Applications International Corp., Moffett Field, CA, USA
An Ontology for Requesting Distant Robotic Action: A Case Study in Naming and Action Identification for Planning on the Mars Exploration Rover Mission
Wales, Roxana C.; Shalin, Valerie L.; Bass, Deborah S.; [2004]; 16 pp.; In English
Contract(s)/Grant(s): NAS2-00065; Copyright; Avail: CASI; A03, Hardcopy

This paper focuses on the development and use of the abbreviated names as well as an emergent ontology associated with making requests for action of a distant robotic rover during the 2003-2004 NASA Mars Exploration Rover (MER) mission, run by the Jet Propulsion Laboratory. The infancy of the domain of Martian telerobotic science, in which specialists request work from a rover moving through the landscape, as well as the need to consider the interdisciplinary teams involved in the work required an empirical approach. The formulation of this ontology is grounded in human behavior and work practice. The purpose of this paper is to identify general issues for an ontology of action (specifically for requests for action), while maintaining sensitivity to the users, tools and the work system within a specific technical domain. We found that this ontology of action must take into account a dynamic environment, changing in response to the movement of the rover, changes on the rover itself, as well as be responsive to the purposeful intent of the science requestors. Analysis of MER mission events demonstrates that the work practice and even robotic tool usage changes over time. Therefore, an ontology must adapt and represent both incremental change and revolutionary change, and the ontology can never be more than a partial agreement on the conceptualizations involved. Although examined in a rather unique technical domain, the general issues pertain to the control of any complex, distributed work system as well as the archival record of its accomplishments.
Author
Mars Exploration; Telerobotics; NASA Space Programs; Mars Roving Vehicles; Mission Planning

20040086980 California Univ., Los Angeles, CA, USA
Parent-Body Modification of Chondritic Meteorites
Rubin, Alan; [2003]; 5 pp.; In English
Contract(s)/Grant(s): NAG5-12215; No Copyright; Avail: CASI; A01, Hardcopy

This proposal focused on the parent-body modification of chondritic materials and substantial progress was made in the last year. A summary of the work accomplished during this period is discussed. The topics include: 1) Chromite-Plagioclase Assemblages in Ordinary Chondrites; 2) The Gujba Bencubbin-like meteorite fall; 3) NWA428: A rock that Experienced Impact-induced Annealing; 4) Spade: An Annealed H-chondrite Impact-melt Breccia; and 5) Post-shock Annealing in

Ordinary Chondrites. A list of the papers submitted or published during the period is also presented.
Derived from text
Chondrites; Meteoritic Composition; Mineralogy; Sedimentary Rocks

20040087098 NASA Ames Research Center, Moffett Field, CA, USA, QSS Group, Inc., Moffett Field, CA, USA
Scaling Up Decision Theoretic Planning to Planetary Rover Problems
Meuleau, Nicolas; Dearden, Richard; Washington, Rich; [2004]; 6 pp.; In English; AAAI-04 Workshop on Learning and Planning in MARK V Processing, 26 Jul. 2004, San Jose, CA, USA; No Copyright; Avail: CASI; A02, Hardcopy

Because of communication limits, planetary rovers must operate autonomously during consequent durations. The ability to plan under uncertainty is one of the main components of autonomy. Previous approaches to planning under uncertainty in NASA applications are not able to address the challenges of future missions, because of several apparent limits. On another side, decision theory provides a solid principle framework for reasoning about uncertainty and rewards. Unfortunately, there are several obstacles to a direct application of decision-theoretic techniques to the rover domain. This paper focuses on the issues of structure and concurrency, and continuous state variables. We describes two techniques currently under development that address specifically these issues and allow scaling-up decision theoretic solution techniques to planetary rover planning problems involving a small number of goals.
Author
Decision Theory; Mars Roving Vehicles; Autonomy; Mission Planning

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SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

20040086888 NASA Ames Research Center, Moffett Field, CA, USA
High-Order Shock-Capturing Methods for Modeling Dynamics of the Solar Atmosphere
Bryson, Steve; Kosovichev, Alexander; Levy, Doron; January 2004; 31 pp.; In English
Contract(s)/Grant(s): NSF DMS-01-33511; 704-40-42; Copyright; Avail: CASI; A03, Hardcopy

We use one-dimensional high-order central shock capturing numerical methods to study the response of various model solar atmospheres to forcing at the solar surface. The dynamics of the atmosphere is modeled with the Euler equations in a variable-sized flux tube in the presence of gravity. We study dynamics of the atmosphere suggestive of spicule formation and coronal oscillations. These studies are performed on observationally-derived model atmospheres above the quiet sun and above sunspots. To perform these simulations, we provide a new extension of existing second- and third- order shock-capturing methods to irregular grids. We also solve the problem of numerically maintaining initial hydrostatic balance via the introduction of new variables in the model equations and a careful initialization mechanism. We find several striking results: all model atmospheres respond to a single impulsive perturbation with several strong shock waves consistent with the rebound-shock model. These shock waves lift material and the transition region well into the initial corona, and the sensitivity of this lift to the initial impulse depends non-linearly on the details of the atmosphere model. We also reproduce an observed 3-minute coronal oscillation above sunspots compared to 5-minute oscillations above the quiet sun.
Author
Coronas; Oscillations; Shock Waves; Conservation Laws; Upwind Schemes (Mathematics); Solar Atmosphere; Numerical Analysis; Atmospheric Models

20040090620 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Elemental Abundance Variations Observed in Solar Energetic Particle Events During Solar Cycle 23
vonRosenvinge, T. T.; Cohen, C. M. S.; Cummings, A. C.; Leske, R. A.; Mewaldt, R. A.; Stone, E. C.; Widenbeck, M. E.; [2004]; 1 pp.; In English; COSPAR 2004, 18-25 Jul. 2004, Paris, France
Contract(s)/Grant(s): NAG5-12929; No Copyright; Avail: Other Sources; Abstract Only

We report on observations of the abundances of elements from Helium to Nickel in over 50 different solar energetic particle events using the Solar Isotope Spectrometer (SIS) on-board the Advanced Composition Explorer (ACE) spacecraft. It had originally been expected that the energy spectra of different elements would show spectral roll-overs at energies related to the Q/M ratio of each element. Due to the partial stripping of Fe and essentially complete stripping of O, it was expected that the Fe/O ratio would be observed to decrease with increasing energy. While many events show this pattern, others have Fe/O which is constant with energy, while for yet others Fe/O actually increases with energy. Events having constant Fe/O

could simply have their spectral breaks outside of the observed energy range. However, events which show increasing Fe/O cannot be explained within the framework of spectral breaks. Possible explanations include injection of remnant heavy ions from earlier impulsive events, hybrid Events consisting of a combination of flare-accelerated and shock-accelerated particles from a single solar event, and some new physical process in shock acceleration. We will report on efforts to distinguish these possible explanations.
Author
Abundance; Solar Corpuscular Radiation; Explorer Satellites; Energetic Particles; Sunspot Cycle

20040095297 California Univ., Los Angeles, CA, USA
Interaction of Strong Transient Interplanetary Disturbances with the Dayside Magnetosphere
Berchem, Jean; [2004]; 3 pp.; In English
Contract(s)/Grant(s): NAG5-12943; No Copyright; Avail: CASI; A01, Hardcopy

The objective of the investigation was to gain an understanding of the complex response of the magnetosphere to strong transient interplanetary disturbances. Because the project was only funded for a year, the investigation focused on only one of the three topics proposed in the original three year proposal. We investigated the response of the dayside auroral region to strong transient interplanetary disturbances. The method of the investigation was to use three-dimensional magnetohydrodynamic (MHD) simulations that employ measurements of the solar wind conditions upstream the bow shock to model actual events and then to compare the simulation results with observations from spacecraft located at downstream locations. We modeled an event that occurred on July 14,2000, for which both CLUSTER and IMAGE simultaneous observations were available. The event was marked by high solar wind dynamic pressure and a strong IMF By component. Comparisons showed a very good agreement between intensifications in the auroral emissions measured by IMAGE
Author
Interplanetary Space; Magnetohydrodynamics; Magnetospheres; Auroral Zones; Wind Direction; Solar Wind

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SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth radiation belts. For biological effects of radiation on plants and animals see *51 Life Sciences*; on human beings see 52 Aerospace Medicine. For theory see *73 Nuclear Physics*.

20040086550 NASA Langley Research Center, Hampton, VA, USA
Solar Particle Event Exposures and Local Tissue Environments in Free Space and on Martian Surface
Kim, M. Y.; Shinn, J. L.; Singleterry, R. C.; Atwell, W.; Wilson, J. W.; [1999]; 3 pp.; In English; Copyright; Avail: CASI; A01, Hardcopy

Solar particle events (SPEs) are a concern to space missions outside Earth s geomagnetic field. The September 29, 1989 SPE is the largest ground-level event since February 23, 1956. It is an iron-rich event for which the spectra are well measured. Because ten times this event matches the ground level data of the February 1956 SPE, it is suggested that an event with ten-times the scaled spectra of the September 29, 1989 SPE be used as a worst case SPE for spacecraft design. For the worst case SPE, the input spectra were reconstructed using Nymmik's (1995) model for protons, the O and Fe ion spectra of Tylka et al. (1997) to evaluate the iron enhancement ratio, and the Solar Energetic Particle Baseline (SEPB) composition of McGuire et al. (1986) for the heavy ions. The necessary transport properties of the shielding materials and the astronaut s body tissues are evaluated using the HZETRN code. Three shield configurations (assumed to be aluminum) are considered: space suit taken as 0.3 g/sq cm, helmet/pressure vessel as 1 g/sq cm, and equipment room of 5 g/sq cm. A shelter is taken as 10 g/sq cm on the Martian surface. The effect of shielding due to the Martian atmosphere is included. The astronaut geometry is taken from the computerized anatomical man (CAM) model.
Author
Space Missions; Data Acquisition; Energetic Particles; Mars Atmosphere; Solar Corpuscular Radiation

20040086573 NASA Langley Research Center, Hampton, VA, USA
Determining the Relationship between the Total and Window Channel Nighttime Radiances for the CERES Instrument
Kratz, David P.; Priestley, Kory J.; Green, Richard N.; [1999]; 3 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Observing Earth s radiant energy budget from space is critical to improving our understanding of Earth s climate system. The Earth Radiation Budget Experiment (ERBE) was the first initiative to provide simultaneous observations of Earth s radiant energy with identical instruments flying aboard separate satellites. The design of the ERBE instrument was based upon three

complementary broadband radiometers which measured the shortwave (\h 5 mm), longwave (\g 5 mm), and total regions of the spectrum. Since any two of the ERBE radiometers could be used to simulate the third, a three channel intercomparison, based on redundancy, was available to uncover any changes in the relative sensitivities of the individual radiometers. Such a three channel intercomparison thus provided confidence in the application of the ERBE measurements over the lifetime of the instrument while mitigating the concern over instrument degradation.
Derived from text
Climate; Earth Observations (From Space); Earth Radiation Budget Experiment; Energy Budgets

20040086662 NASA Langley Research Center, Hampton, VA, USA
Protection from Space Radiation
Tripathi, R. K.; Wilson, J. W.; Shinn, J. L.; Singleterry, R. C.; Clowdsley, M. S.; Cucinotta, F. A.; Badhwar, G. D.; Kim, M. Y.; Badavi, F. F.; Heinbockel, J. H., et al.; [2000]; 4 pp.; In English; Copyright; Avail: CASI; A01, Hardcopy

The exposures anticipated for our astronauts in the anticipated Human Exploration and Development of Space (HEDS) will be significantly higher (both annual and carrier) than any other occupational group. In addition, the exposures in deep space result largely from the Galactic Cosmic Rays (GCR) for which there is as yet little experience. Some evidence exists indicating that conventional linear energy transfer (LET) defined protection quantities (quality factors) may not be appropriate [1,2]. The purpose of this presentation is to evaluate our current understanding of radiation protection with laboratory and flight experimental data and to discuss recent improvements in interaction models and transport methods.
Author
Extraterrestrial Radiation; Radiation Protection; Radiation Dosage

20040087002 NASA Langley Research Center, Hampton, VA, USA
Point Response Characteristics for the CERES/EOS-PM, FM3 & FM4 instruments.
Paden, Jack; Smith, G. Louis; Lee, Robert B., III; Pandey, Dhirendra K.; Priestley, Kory J.; Thomas, Susan; Wilson, Robert S.; [1998]; 12 pp.; In English
Contract(s)/Grant(s): NAS1-19570; No Copyright; Avail: CASI; A03, Hardcopy

This paper describes the point source functions (PSF s) of the Clouds and the Earth s Radiant Energy System (CERES,) Earth Observing System (EOS,) afternoon platform (PM,) Flight Model 3 (FM3,) and Flight Model 4 (FM4) scanning instruments. The PSF (also known as the Point Response Function, or PRF) is vital to the accurate geo-location of the remotely sensed radiance measurements acquired by the instrument. This paper compares the characteristics of the FM3 and FM4 instruments with the earlier Proto Flight Model (PFM) on the Tropical Rainfall Measuring Mission (TRMM) platform, and the FM1 and FM2 Models on the EOS morning orbiting (AM) platform, which has recently been renamed 'Terra". All of the PSF s were found to be quite comparable, and the previously noted 'spreading' characteristic of the window (water vapor) channel PSF is analyzed Keywords: PSF, PRF, CERES, TRMM, EOS, Earth Radiation Budget
Author
Earth Radiation Budget; Point Sources; Radiant Flux Density; Remote Sensing

20040087145 NASA Langley Research Center, Hampton, VA, USA
Astronaut Exposures to Ionizing Radiation in a Lightly-Shielded Spacesuit
Wilson, J. W.; Simonsen, L. C.; Shinn, J. L.; Kim, M.-H. Y.; Cucinotta, F. A.; Badavi, F. F.; Atwell, W.; [1999]; 13 pp.; In English
Report No.(s): Paper 1999-01-2173; Copyright; Avail: CASI; A03, Hardcopy

The normal working and living areas of the astronauts are designed to provide an acceptable level of protection against the hazards of ionizing radiation of the space environment. Still there are occasions when they must don a spacesuit designed mainly for environmental control and mobility and leave the confines of their better-protected domain. This is especially true for deep space exploration. The impact of spacesuit construction on the exposure of critical astronaut organs will be examined in the ionizing radiation environments of free space, the lunar surface and the Martian surface. The computerized anatomical male model is used to evaluate astronaut self-shielding factors and to determine space radiation exposures to critical radiosensitive human organs.
Author
Ionizing Radiation; Aerospace Environments; Environmental Control; Space Suits; Organs; Protection

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GENERAL

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs such as Apollo, Gemini, and Mercury spacecraft, Earth Resources Technology Satellite (ERTS), and Skylab; NASA appropriations hearings.

20040095359 NASA, Washington, DC, USA

Exploring the Unknown

Logsdon, John M., Editor; Garber, Stephen J., Editor; Launius, Roger D., Editor; 2004; 780 pp.; In English

Report No.(s): NASA/SP-2004-4407/Vol.VI; No Copyright; Avail: CASI; A08, Hardcopy

One of the most important developments of the twentieth century has been the movement of humanity into space with machines and people. The extension of human activity into outer space has been accompanied by a high degree of self-awareness of its historical significance. Because most of the activity in outer space was carried out under government sponsorship, it was accompanied by the documentary record required of public institutions, and there has been a spate of official and privately written histories of most major aspects of space achievement to date. When top leaders considered what course of action to pursue in space, their deliberations and decisions often were carefully put on the record. There is, accordingly, no lack of material for those who aspire to understand the origins and evolution of U.S. space policies and programs.This reality forms the rationale for this series. Precisely because there is so much historical material available on space matters, the National Aeronautics and Space Administration (NASA) decided in 1988 that it would be extremely useful to have easily available to scholars and the interested public a selective collection of many of the seminal documents related to the evolution of the U.S. civilian space program. While recognizing that much space activity has taken place under the sponsorship of the Department of Defense and other national security organizations, the U.S. private sector, and in other countries around the world, NASA felt that there would be lasting value in a collection of documentary material primarily focused on the evolution of the U.S. government s civilian space program, most of which has been carried out since 1958 under the Agency s auspices. As a result, the NASA History Office contracted with the Space Policy Institute of George Washington University's Elliott School of International Affairs to prepare such a collection. This is the sixth volume in the documentary history series; two additional ones containing documents and introductory essays related to human space flight, including microgravity research in Earth orbit, will follow. The documents collected during this research project were assembled from a diverse number of both public and private sources. A major repository of primary source materials relative to the history of the civil space program is the NASA Historical Reference Collection of the NASA History Office located at the Agency s Headquarters in Washington, DC.

Derived from text

Histories; Space Programs; NASA Programs

Subject Term Index

Personal Author Index